SERVICE FORCES MANUAL

M 357-13

CIVIL AFFAIRS HANDBOOK
THE
NETHERLANDS

SECTION 13 : PUBLIC HEALTH AND SANITATION

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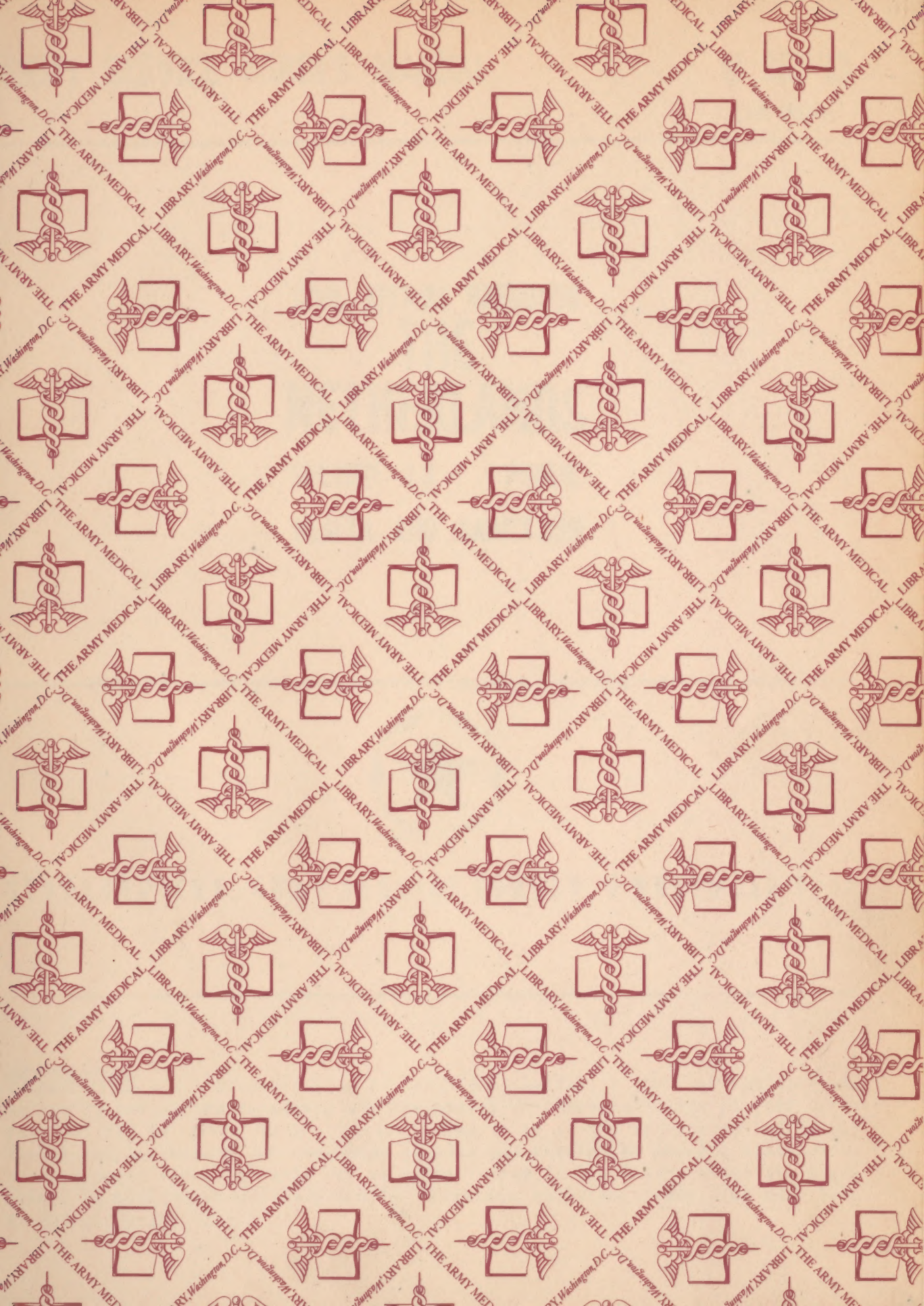
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NUMBERING SYSTEM OF

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M1 - M99	Basic and Advanced Training
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HEADQUARTERS, ARMY SERVICE FORCES,
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Army Service Forces Manual M 357-13, Civil Affairs Handbook - The Netherlands, Section 13, Public Health and Sanitation, has been prepared under the supervision of The Provost Marshal General, and is published for the information and guidance of all concerned.

[SPX 461 (21 Sep 43).]

By command of Lieutenant General SOMERVELL:

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CIVIL AFFAIRS HANDBOOKS

TOPICAL OUTLINE

1. Geographical and Social Background
2. Government and Administration
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10. Public Works and Utilities
11. Transportation Systems
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13. Public Health and Sanitation*
14. Public Safety
15. Education
16. Public Welfare
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*This preliminary study on Public Health and Sanitation in The Netherlands was largely prepared by the MEDICAL INTELLIGENCE BRANCH OF THE OFFICE OF THE SURGEON GENERAL.

INTRODUCTION

Purposes of the Civil Affairs Handbook.

The basic purposes of civil affairs officers are (1) to assist the Commanding General by quickly establishing those orderly conditions which will contribute most effectively to the conduct of military operations, (2) to reduce to a minimum the human suffering and the material damage resulting from a disorder and (3) to create the conditions which will make it possible for civilian agencies to function effectively.

The preparation of Civil Affairs Handbooks is a part of the effort to carry out these responsibilities as efficiently and humanely as is possible. The Handbooks do not deal with plans or policies (which will depend upon changing and unpredictable developments). It should be clearly understood that they do not imply any given official program of action. They are rather ready reference source books containing the basic factual information needed for planning and policy making.

Revision for Final Publication.

The material in this section was largely prepared by the MEDICAL INTELLIGENCE BRANCH OF THE OFFICE OF THE SURGEON GENERAL. If additional data becomes available it will be incorporated in the final draft of the handbook on the Netherlands.

OFFICERS USING THIS MATERIAL ARE REQUESTED TO MAKE SUGGESTIONS AND CRITICISMS INDICATING THE REVISIONS OR ADDITIONS WHICH WOULD MAKE THIS MATERIAL MORE USEFUL FOR THEIR PURPOSES. THESE CRITICISMS SHOULD BE SENT TO THE OFFICE OF THE CHIEF OF THE SURVEY AND RESEARCH SECTION, MILITARY GOVERNMENT DIVISION, P. M. G. O., 2807 MUNITIONS BUILDING, WASHINGTON 25, D. C. (OR PHONE WAR DEPARTMENT EXTENSION 76322).

PRELIMINARY

Subject to Revision

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PRELIMINARY

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PUBLIC HEALTH AND SANITATION - NETHERLANDS

a. Organization.

In the Netherlands a Central Council of Public Health (Centrale Gezondheidsraad) acted in a general advisory capacity to the Government and to the different Ministries. It functioned in liaison with the State Public Health Service (Dienst van de Volksgezondheid). The President and Secretary of this Council were regular government officials. The 70 members were partly officials, partly specialists in the different public health and medical fields. If necessary, other experts were invited. This council not only answered the questions put before it by the Government, but on its own initiative advised the Government as to the dangers to public health and as to control measures to be taken.

The State Public Health Service was under the control of the Ministry of Social Affairs (Ministerie van Sociale Zaken). At its head was a Director General who was responsible to the Minister. He was assisted by several chief inspectors.

The Chief Medical Inspector and his inspectors received reports of infectious diseases, supervised the enforcement of the quarantine laws, and inspected hospitals. He was also responsible for the supervision of the training of midwives and for the enforcement of the medical practice

laws. There were inspectors for infant and child hygiene, for the antituberculosis campaign, for the hygiene of atmosphere, soil and water, for food inspection, and for the implementation of the pharmaceutical laws. There was a special inspector for the anti-alcoholic campaign, a special chief inspector for the sanitary conditions of habitations and one for meat inspection.

Practically every city and township had a municipal public health service. These services were usually well organized and were ultimately supervised by the State Public Health Service. Public health work in the Netherlands was greatly facilitated by the presence of many central and regional laboratories. The Municipal Health Service of Amsterdam had the following departments:

(1) Medical treatment of the poor;
(2) Admission to the municipal hospitals;
(3) First aid and transport of accident victims;
(4) Dispensaries for obstetrics, orthopedic surgery, dental care, eye diseases, trachoma, favus, venereal diseases, and psychiatry;
(5) Infant - and preschool clinics;
(6) School hygiene (including nutrition);
(7) Communicable diseases;
(8) Public baths and swimming pools;
(9) Food, food-shops, slaughterhouses, and refrigeration plants;
(10) Water supply, sewage and garbage removal;
(11) Medical Statistical Bureau, laboratories, etc.

Prior to 1934, every community with more than 18,000 inhabitants had to appoint a "health commission" consisting

of physicians, engineers, and teachers. These commissions advised the municipal councils about measures to be taken by the local public health services. In 1934 these commissions were abolished and most of their work taken over by the public health inspectors.

(1) The veterinary service belonged to the Ministry of Economic Affairs (Ministerie van Economische Zaken). There was a veterinary director and an assistant director, three chief inspectors, eleven provincial inspectors, and many substitute part-time inspectors. The veterinary service had its own serum plant and its own veterinary central laboratory, both in Rotterdam. A special inspector was appointed for the tuberculosis campaign amongst cattle. The ninety meat export slaughterhouses had their special government veterinary inspectors.

(2) The organization of the public health service in the Netherlands was highly satisfactory. Although the State Public Health Service took care of special parts of the program, a considerable part was left to municipal organizations (public health services, slaughterhouses, waterworks) and to private initiative (antituberculosis and antivenereal campaigns). The Government gave support and often financial help to such private endeavors and at the same time the State Public Health Service closely supervised the work of these municipal and private organizations.

The results of this system were satisfactory. The general health of the population was good, the incidence and fatality of communicable diseases low, and the total mortality, tuberculosis mortality, infant mortality, and neonatal mortality compared favorably with the best figures in other parts of the world.

b. Social Services.

In 1875 a White Cross Association was founded in North Holland. Its function was to provide good care and good nursing to sick people who were unwilling to go to a hospital. This organization has gradually spread over the other 10 provinces of the Netherlands and has ultimately been called the Green-White Cross Federation. In 1936, the eleven provincial Green-White Cross associations had 1,027 local branches with 460,000 members. In every village, a Green-White Cross center was available. Here the paraphernalia needed for the treatment of the sick were stored (air cushions, bed-pans, special beds, apparatus for baking, for electrical treatment, for diathermy, etc.) and were loaned free of cost to the members of the Federation. Little open huts could be swivelled around so that the patients could always be protected against wind and air currents. The Federation had undertaken widespread training of visiting nurses, and most of the district nurses in the

in the Netherlands were Green-White Cross nurses. The Federation also provided domestic help to take over the housework and the care of children of sick women.

Transportation of patients to and from hospitals, sending of children to holiday resorts and to summer camps, the construction of convalescent homes, of tuberculosis sanatoria, the organization of well-baby clinics and of infant dispensaries, the building of disinfection plants and of public baths, have all been undertaken by this Federation. Furthermore, it has very closely collaborated in the anti-tuberculosis and anti-venereal campaigns. In the rural areas, the largest part of the latter campaigns was in the hands of the Green-White Cross Federation. In this way the Federation has widely contributed to the general introduction of the knowledge of public health and preventive medicine. It also has had an important influence upon the improvement of housing.

The Netherlands Red Cross has existed since 1867. It had an extensive field of activities, even in peacetime. Two large Red Cross Hospitals, active interest and cooperation in the anti-tuberculosis and anti-malaria campaigns, close collaboration with First Aid Societies, organization of Blood Transfusion Services - all of those were a part of its program.

c. Medical and Related Care.

(1) Doctors. Nurses, Dentists, and Others

In 1938, 6,284 physicians were registered in the Netherlands (one physician per 1,432 inhabitants). All these physicians were licentiates of Dutch medical schools and their ability came up to international standards. 404 communities had physicians and midwives, 396 communities had only one or more physicians, 23 communities had only midwives, and in 233 there were neither physicians nor midwives. The greater part of the latter communities had less than 2,000 inhabitants. The ethical level of the medical profession in the Netherlands was high. The medical profession as a whole has been unwilling to cooperate with the German occupying powers as soon as they felt that their professional ethics were involved. Consequently a considerable number of the physicians have been sent to Germany, Poland, or to internment camps. In 1938, 4,481 graduate nurses and 4,855 student nurses were working in the hospitals in the Netherlands. A large corps of visiting nurses (1,400) and obstetrical nurses was also available; 5,400 nurses worked in the mental disease hospitals. There were 1,252 dentists (one per 6,900 inhabitants) in 1938. 1,026 midwives, 799 pharmacists, and 2,788 assistant pharmacists were registered in the Netherlands in 1938. Of 174,612

deliveries in 1937, 50.7 per cent were performed by physicians, 49.1 per cent by midwives; in case of complications, the latter must consult a physician.

(2) Medical Institutions, including Laboratories.

The Netherlands had four complete medical schools, all connected with universities (Amsterdam, Groningen, Leiden, Utrecht). The University of Amsterdam was municipal, the other three were State universities. The Calvinistic University in Amsterdam had an incomplete medical faculty consisting of departments of physiology and neuropsychiatry.

The curriculum of the medical schools in the Netherlands took about seven years, one year of which was devoted to biology, physics, and chemistry. The average number of graduates emerging annually from each medical school was about 100. There was a dental school in Utrecht, a veterinary school in Utrecht, and an agricultural school in Wageningen.

A Central State Public Health Institute (Ryks Instituut voor de Volksgezondheid), with bacteriological, serological, chemical, pharmacological, and veterinary divisions, was located in Utrecht and took care of the analytical and bacteriological work for the Government. Every physician in the Netherlands could send his specimens free of cost to this laboratory. All the municipal public

health services had organized diagnostic laboratories which, operating as regional diagnostic laboratories, wer manned by an experienced staff. A Serological Institute and Pasteur Institute manufactured vaccines and serums and were combined with the State Public Health Laboratory. The necessary vaccines and serums were manufactured in Utrecht, but smallpox vaccine was prepared in Amsterdam, Rotterdam, and Groningen in laboratories especially established for this purpose many years ago by private medical enterprise. The veterinary service had its own central laboratory and serum plant in Rotterdam. A special Government Institute took care of the water supply problems, another studied and helped to prevent soil pollution.

Apart from actual hospitals, many borderline institutions were found in the Netherlands. Several watering resorts on the coast of the North Sea and other spas had institutions which provided medical treatment by staff physicians. Numerous rest houses were scattered over the country; some of these had house physicians, at least part of the time. Some psychiatric institutions were on the borderline between hospitals and asylums. Apart from the institutions mentioned, there were in 1938 261 regular hospitals in the Netherlands with 31,299 beds (one per 280 inhabitants). Amsterdam alone had 19 hospitals with 4,561 beds (one per

175 inhabitants). During the year 1937, 290,956 patients were admitted to the hospitals, the number of hospital days was 8,125,931. Apart from these hospitals, 42 mental disease hospitals with 25,000 beds were available. Seventy-six per cent of the typhoid patients, 30 per cent of the scarlet fever patients, and 53 per cent of the diphtheria patients were admitted to hospitals. 20,686 deliveries took place in hospitals (11.84 per cent of the total number). In Amsterdam this figure went up to 40 per cent, but in the rural areas nearly all deliveries took place at home. The total still-birth rate of the home deliveries was 1.11 per cent, the still-birth rate of full-time babies 0.74 per cent. The total maternal mortality was one per 1,000 live births. Practically all these hospitals were well equipped, those in the larger cities comparing favorably with the best in other countries.

(3) Supplies.

Hospital supplies were always plentiful. Especially favorable circumstances consisted in the quinine production in the Netherlands East Indies, the presence in the Netherlands of one of the most important European plants (Organon) for the preparation of endocrine products (later also engaged in the production of other pharmaceutical products), and the presence of the Philips bulb and radio factories, where x-ray machines were manufactured. It is evident that all this must have changed during the occupation.

d. Birth, Death, and Disease.

1. Statistics.

The following figures indicate the percentage increase of deaths in 1941 as compared with 1939:

Influenza	124%
Tuberculosis	47%
Bronchitis	36%
Pneumonia	20%
Communicable diseases (exclusive of tuberculosis and influenza	98%
Diarrhea and enteritis	54%

The spread of communicable diseases will increase progressively during the occupation, because of nutritional deficiencies and lack of medical supplies. During the first eleven months of 1942 the number of diphtheria cases increased more than tenfold as compared with the same period in 1939, the number of dysentery cases six and one-half times, the number of cases of poliomyelitis more than three times.

An examination of school children in Rotterdam by the Public Health Service in the summer of 1942 has shown that only 36 per cent received sufficient vitamins in their daily diets to prevent rickets. In the course of 1943 not only rickets but also "osteomalacia" of the adolescent and avitaminosis A and B must necessarily have occurred. As far as known, potatoes are still available, although in certain

areas they have also been scarce. As long as the regime consists largely of potatoes the chances of avitaminosis C are small.

2. Diseases of Special Military Importance.

(a) Malaria. It is highly probable that in former times malaria was extremely common in the Netherlands. Between 1849 and 1866, the medical practitioners of Amsterdam kept careful statistics about the occurrence of malaria in this city. They found an annual average of 5,268 malaria cases with a minimum of 1,963 cases in 1861 and a maximum of 23,872 in 1857 (155 per thousand). Between 1920 and 1936 the annual average of malaria in Amsterdam was only 418 cases, with a minimum of 15 in 1932 and a maximum of 2,391 in 1922 (3 per thousand).

Notwithstanding this significant decrease of the malaria morbidity, malaria has not been eradicated in the Netherlands and is, at least in the province of North Holland, a disease of military importance. In Amsterdam 141 cases were reported in 1938; 243 in 1939; but the number of malaria cases which actually occurred in this city in 1939 was estimated as 800. In the rest of the provinces of North Holland, 1,703 malaria cases were observed in 1938, 1,100 in 1939. Another malarious area is still found in the western part of Friesland. The other foci of malaria are unimportant.

This means that since 1875 the distribution of malaria has not changed much in the Netherlands; only a few foci which existed in 1875 (northeastern part of South Holland and parts of Utrecht) have disappeared. (Figs. 9 and 10).

In the olden days, quartan fever was frequent in the Netherlands in general, in Amsterdam in particular. Nowadays quartan is never met with in Amsterdam, and it is extremely rare in the rest of the Netherlands. Estivo-autumnal fever is not uncommonly seen in patients returning from the Netherlands East Indies, but it never spreads among the population. Plasmodium falciparum needs a high temperature in order that oocysts can develop and that the sporozoites remain viable, much higher than the average temperature in the Netherlands.

Extensive distribution of quinine, free or at very low prices, cutting down the period during which the patient is a source of anopheline infection, is considered to be one of the main factors for the decrease of malaria prevalence in the Netherlands. Malaria remains rampant only in areas where the anopheline density is sufficient to keep the disease going on the scanty infection the healthy parasite carriers provide. This is, for instance, the case in North Holland.

The reason why North Holland is a malarious area, but South Holland and the adjacent lowlands of Utrecht are

practically malaria-free, cannot be explained by a change of the landscape. But although the character of the country remains the same the water does not. The water of North Holland is brackish (Fig. 8) which allows the A. (labranchiae) atroparvus, a potent malaria vector, to develop in large numbers. South Holland is characterized by the fluviatile deposits of the arms of the Rhine. These deposits contain large stores of fresh water where the A. messeae which in the Netherlands does not act as a vector, abounds.

Annual variances of malaria incidence have been carefully studied in the Netherlands in at least eight different villages and cities. All of these have been affected by the same major epidemic outbreaks (1900 to 1902, and 1919 to 1922). No explanation can be given for these variations in frequency. (Fig. 11). In other countries the malaria pandemic of 1919 and the following years has often been associated with the World War and ascribed to the return of malaria-infected soldiers. But the Netherlands were not involved in the first World War. Here no transport of malaria germs by demobilized soldiers could have taken place and yet here, too, epidemics of malaria were observed around 1922. In non-epidemic years, malaria may affect only a fraction of one per cent of the population even in the malarious areas.

In epidemic years this figure often goes up to 12-15 per cent. In the regions where chronic malaria is endemic the number of "healthy" parasite carriers is at least as large as the number of persons who require medical help for their malaria. These healthy carriers, who cause the house they live in to become a focus for anopheline infection, are much more dangerous than the actual malaria patients (Fig. 12). Children are less liable to develop fever than adults in the carrier state and thus children are still more dangerous carriers than are adults.

The importance of the healthy human carrier for the anopheline infection explains why quinine prophylaxis does not further diminish malaria frequency; the reservoir consisting of healthy carriers does not diminish because they do not feel sick and thus are not treated.

It should be added that even in the malaria regions of the Netherlands, malaria is always patchily distributed. In one village, some streets may be heavily infected, while others are malaria-free. Some villages are notorious for their "malariousness"; other villages in the neighborhood may be free. In Amsterdam malaria occurs in the northern part of the city; in the rest of the city malaria is relatively rare.

The Plasmodium vivax which is prevalent in the

Netherlands has a tendency to remain latent for many months after the sporozoites have entered the human body by the bite of an Anopheles. This is probably the reason why malaria is most frequent in May, June, and July, although human infection is limited to August, September, and October. The outstanding feature of malaria in the Netherlands consists in the rareness of fresh cases of malaria during August and September, the months when the infection rate of the anophelines is highest. When the incidence of human malaria is at its peak, the Anopheles atroparvus is not infected. (Fig. 7).

The tendency of the P. vivax of the Netherlands to remain latent for many months is the reason why 25 to 50 per cent of the artificial infections with Dutch malaria strains, performed to influence the course of cases of general paresis, remain latent. In later years another P. vivax, the Madagascar strain of James, was used for these therapeutic infections.

Tertian malaria in the Netherlands is not a dangerous disease. It is tedious because of its tendency to relapse, but it does not kill. At the very worst, it is in old and decrepit people an accessory to the cause of death. Blackwater fever occurs rarely if at all.

(b). Venereal Diseases. The figures for venereal

disease frequency were remarkably low in the Netherlands, and have been decreasing continuously since 1925. In North Holland, with 1,614,000 inhabitants, 87 fresh cases of syphilis and 446 fresh cases of gonorrhea were reported in 1937 by family physicians. The specialists working in this area added 198 cases of syphilis and 98 cases of gonorrhea. There were a few areas where syphilis was more frequent. (Enschede in the eastern part of the country near the German border where 63 fresh cases of syphilis occurred in 1936, 54 in 1937).

These data agree with other figures published of 11 cases of syphilis, 59 gonorrhea, and 2 of chancroid per 100,000 inhabitants. Cases of lymphogranuloma venereum are mainly imported by sailors; they have caused occasional infections locally. Granuloma inguinale does not occur.

The Netherlands Society for the campaign against venereal diseases has with subvention and under supervision of the Government established 18 different consultation bureaus with social workers attached all over the Netherlands. This society works in close cooperation with the provincial Green-White Cross societies. In 1937, 973 new and old venereal patients were treated in these bureaus. Here social workers carry on the epidemiological investigations.

(c). Leptospirosis. Before 1924 only a few sporadic cases of leptospirosis had been observed in the

Netherlands. Since then the number has increased considerably and in 1932 a definite epidemic occurred in the Netherlands. In the last few years the number has gone down again to very small values.

Year	No. of Cases Reported	No. of Deaths
1929	13	2
1930	26	4
1931	30	3
1932	207	16
1933	156	17
1934	118	17
1935	93	3
1936	69	7
1937	96	13
1938	85	11
1939	30	?

The disease is most frequent in the low-lying provinces with abundant water. Rotterdam has by far the most cases.

Of 374 cases where careful bacteriological investigation was possible, 362 were due to Leptospira icterohemorrhagiae, 12 to L. canicola. In 337 cases the probably source of infection could be traced. One hundred ninety-seven cases occurred in swimmers, 60 cases were due to submersion, 68 to occupational hazards (16 fishermen, 26 divers, seamen and reed cutters, 26 workers in slaughterhouses, sewers, butter factories, barns and stables where rats abound). Thus, only in 9 per cent of the cases were the patients brought in direct contact with rats by their occupation. All the other cases were due to contact with

water. In the latter category, however, the actual cause of infection remains the rat, because it carries the Leptospirae and passes them through the urine into the water. Accidental falls into the water are a not infrequent cause of the disease. The canals of Amsterdam are notorious in this respect. Of 972 persons who suffered involuntary submersion in this city between 1928 and 1932, 13 contracted the disease. Swimmers are especially endangered when the water of the pool is more or less stagnant and when no rat-proof netting protects the pool.

Most cases occur between June and November, the largest number between July and September; infection is possible, however, throughout the whole year. Jaundice occurs only in one-third to two-thirds of the cases. The total number of cases reported increases immediately as soon as attention is given to the nonicteric cases. The latter group shows hardly any fatalities (only one in the Netherlands). The L. canicola cases were neither icteric nor fatal. The only known carrier for this spirochaete is the dog.

3. Diseases of Potential Military Importance. --

(a). Enteric Diseases.-(i) Typhoid and Paratyphoid Fevers. Before reliable water supplies and sewage disposal facilities were available, the typhoid figures in

the Netherlands were high. Between 1900 and 1904 the typhoid morbidity was 54 per 100,000. In 1910 this figure had gone down to about 30; in 1930 to 8; in 1937 to 3, in 1938 to 2.5. The fatality varied in different years from 12 to 20 per cent. In small communities the absence of satisfactory facilities for the removal of sewage leads to the infection of ditches. The latter are often used at the same time to wash milk cans and as a source for drinking water. This explained, for instance, the endemicity of typhoid in the picturesque and much-visited fisherman's village of Volendam where a central sewerage system was not introduced until 1939.

The paratyphoid morbidity was 6.0 per 100,000 in 1937, and 2.5 per 100,000 in 1938. The fatality rate was low and usually varied between 2 and 3 per cent. In some years, most of the cases reported as paratyphoid were of the gastro-enteritic type; in other years, the majority showed a typhoid-like syndrome.

Paratyphoid A hardly ever, if ever, occurred in the Netherlands. Most of the cases of paratyphoid reported in the Netherlands were paratyphoid B. In the Netherlands all forms of salmonellosis were reported as paratyphoid fever. Salmonellosis cases caused by infected duck eggs were not infrequent. In different investigations 2.2 and 2.8 per cent of fresh normal duck eggs were proved to

contain Salmonella aertrycke, S. typhi murium (but with delayed rhamnose fermentation) or S. enteritidis var. Essen (but with delayed dulcitol fermentation). Of the apparently normal ducks examined, 38 per cent showed positive serological evidence of Salmonella infection. Such ducks often suffer from oophoritis and salpingitis, which explains the presence of the bacteria in the egg yolks. Human infection takes place when fresh duck eggs are used for the preparation of ice cream, pudding, mayonnaise, meat loaf, pastry, etc. Infected pigeon eggs have also - though more rarely - caused outbreaks of Salmonella infections.

(ii) Dysentery. The number of cases of bacillary dysentery reported in the Netherlands must be much smaller than the actual frequency. In 1936, 386 cases (8 deaths), in 1937, 408 cases (7 deaths), in 1938, 1,000 cases (10 deaths) were reported. In Amsterdam about 20 per cent of the cases which were examined bacteriologically were due to the Flexner group, about 80 per cent to the Sonne bacteria; in the Central Laboratory in Utrecht, Sonne infections were twice as frequently found as Flexner bacilli (100:65). Shiga dysentery was practically nonexistent. In 1899 a small Shiga epidemic was due to a patient who had contracted the disease in the United States; in 1900 a small outbreak in another area occurred through a patient

infected in Germany. Since 1912, no cases had been reported until 1938 when one patient with Shiga dysentery was described. In this case the infection had been contracted in Italy.

Amebic dysentery was rare in the Netherlands, but most clinically recognizable cases occurred in people repatriated from the Netherlands East Indies. Occasionally, locally infected cases occurred, sometimes, but not always, in the neighborhood of people who had lived in the Netherlands East Indies. Swimming in the neighborhood of ships which had just returned from the tropics was considered to be a source of infection. The total number of cases reported was only 8 in 1936, 17 in 1937, 19 in 1938. Careful examination of the stools of apparently normal people revealed, however, that cysts of Endameba histolytica were not infrequently found (about 20 per cent).

Balantidiosis. Infections with Balantidium coli are practically never seen in the Netherlands. One case has been described in a man who raised hogs without even the most elementary hygienic precautions.

Giardiasis. Patients with cholecystitis and diarrhea who at the same time had Giardia in the stools were not infrequent. It is, however, doubtful whether this protozoon can be considered as the etiology of these diseases.

Common Diarrheas. As in the rest of Western

Europe, common diarrheas occur in the Netherlands, partly due to unrecognized Salmonella infections, and probably partly due to unrecognized bacillary dysentery. Usually the etiology remains unknown.

(b) Typhus. Although serious typhus epidemics raged in Holland during the 19th century till about 1880, Rickettsia infections have become extremely rare in the 20th century. In Amsterdam a small outbreak of 35 cases was observed in 1910. In Rotterdam an epidemic of 498 cases with 91 deaths was observed in 1918 and 1919. This epidemic was started by prisoners released from camps in Germany and waiting in Rotterdam for passage to other countries. From these foci cases developed among the poorest part of the population of Rotterdam. In 1920 foreigners were allowed to enter the eastern boundary of Holland only via one special railway station where they were treated carefully in a delousing plant. In this way the typhus epidemic was stopped immediately. Since 1920 no cases of typhus have occurred in the Netherlands.

(c) Cerebrospinal Meningitis. The number of cases of cerebrospinal meningitis reported in the years before 1916 never exceeded 40 per year. In 1916 during the mobilization for the first World War, an epidemic of 226 cases and in 1917 one of 580 cases was observed. In 1918, the number had

gone down to 148 cases; since then the annual number has varied between 89 and 178. Even during the occupation it has not exceeded 200. Before the sulfonamide period the fatality had always been around 50 per cent.

(d) Influenza. The fluctuations in the frequency of influenza ran parallel with the epidemiology of this disease in the rest of the world. A severe pandemic with a high mortality in 1918 and 1919 was followed by years showing a decrease in number of cases, occasionally interrupted by smaller epidemic outbreaks. The mortality due to influenza in 1932 was 1,419 cases; 1933, 1,745; 1934, 899; 1935, 1,590; 1936, 1,561; in 1937 it went up to 3,156; but in 1938 diminished to 1,100; in 1939 to 1,907 cases.

Encephalitis after influenza was not infrequent in the Netherlands. In 1936, 14 fatal cases, in 1937, 102 deaths from influenza encephalitis were reported.

(e) Asthma and Hayfever. The picture and the frequency of these affections are not different in the Netherlands from the neighboring areas. The common allergens in the Netherlands are feathers, animal hair and animal dandruff, different foodstuffs, and especially house dust. It has been stressed that in this country the dust of matresses, for instance, often contains dead and living mites (Glyciphagus domesticus, Gl. ornatus), and moulds, as Aspergillus fumigatus, all of which act as sensitizing

material. Hayfever in the early part of the season (May-June) is mainly caused by pollens of grass or one of the grains. The most frequent allergens are the pollens of rye (Secale cereale) and of Timothy grass (Phleum). The other pollens liable to cause hayfever are Holcus mollis (velvet grass); Cynosurus (dog's tail); Festuca (fescue); Lolium (hay grass); Dactylis (orchard grass); Alopecurus (fox tail); Agrostis (bent grass); Avena flava (oats); Molinia (moor grass); Hordeum secale (barley); Poa pratensis (blue grass); Triticum (wheat); Arrhenatherum (tall oat grass). The hayfever cases occurring later in the summer are mainly due to ragweed, goldenrod, chrysanthemum, dahlia, sweet gage, and aster.

(f) Cholera. In the 19th century, serious cholera epidemics raged in the Netherlands. The first dangerous outbreak was in 1832. In 1848, more than 22,000 people died of this disease, in 1866 about 20,000. The last cholera years were 1892 (the year of the great cholera epidemic in Hamburg) with 293; 1893 with 263; and 1894 with 228 cases. Since then cholera has not been observed in the Netherlands, apart from a small outbreak in Rotterdam in 1909 due to a harbor infection (34 cases with 15 deaths).

(g) Plague. During the last centuries plague epidemics have not been observed in Western Europe. Still,

ships containing living plague rats have occasionally entered Dutch harbors, where Norwegian rats abound and the X. cheopis occurs. Since 1913 no plague rats have been found on ships in the Netherlands.

4. Serious Diseases of Non-Military Importance but Likely to Affect Small Numbers of Troops.

(a.) Tuberculosis. In the Netherlands the tuberculosis mortality has gone down regularly since 1901. Between 1910 and 1915 it had reached an average of 147.5 per 100,000 inhabitants. During the first World War nutrition in the Netherlands deteriorated and the tuberculosis figures became less favorable; in 1918, the year of the influenza epidemic, the tuberculosis death rate went up to 202.5. Thereafter, regular improvement set in again. In 1919 the death rate from tuberculosis was 173.5; in 1920 146.2; in 1922 114.5. In 1937 it had gone down again to 47.9; in 1938 to 45.5; in 1939 to 41.0. During the occupation the tuberculosis mortality increased to 62 per 100,000 in 1941. Before the war, about 70 per cent of the tuberculosis mortality was due to tuberculosis of the respiratory organs, 30 per cent to infection of the other organs. Tuberculosis does not belong to the reportable diseases in the Netherlands and the tuberculosis morbidity is therefore not known. It is

usually considered to be about nine times as large as the tuberculosis mortality. A certain indication as to prevalence is found in the following figures:

In 1932 outbreaks of tuberculosis in schools drew the attention of the Dutch authorities to the danger of tuberculous schoolteachers. In 1934 a law was made which forbade teachers with active lung tuberculosis to partake in teaching. During the next two years 70,300 apparently normal teachers were examined; apart from the 0.4 per cent with active tuberculosis, 3 per cent could only be permitted to teach conditionally. Comparable findings were reported in the 19-year-old boys drafted for military service: 0.2 per cent active tuberculosis found by x-ray examinations in 1938. The marked decrease of tuberculosis morbidity and mortality in the Netherlands must be ascribed in part to the high caloric intake which even the less prosperous inhabitants of the Netherlands can permit themselves, to the favorable housing conditions for the working class and to the widespread organization of the anti-tuberculosis campaign. About 50 per cent of the persons who have open lung tuberculosis are under the supervision of the tuberculosis dispensaries, which means that contact investigation and preventive measures in the family of these

tuberculosis patients must help to keep the tuberculosis in check.

In 1937, 4,412 sanatorium beds were available for the care of tuberculosis; 1,135 of these beds were especially reserved for children with tuberculosis. Apart from the sanitorium beds, 1,236 special tuberculosis beds were available in general hospitals.

It should be emphasized that whereas the total mortality from tuberculosis in the Netherlands compares so favorably with the figures published from other countries, bovine tuberculosis in humans is a widespread disease in Holland. In Amsterdam and in all the other cities with more than 100,000 inhabitants, 20 per cent of the extra-pulmonary tuberculosis in children below 15 years was caused by bovine bacilli. In the rural communities this figure rose to around 40 per cent. Even 10 per cent of the cases of lung tuberculosis in children below 15 years were due to bovine tubercle bacilli. This figure was the same in the large cities as in the rural communities. This bovine lung tuberculosis in children is probably a localization of the intestinal infection. The percentage of lung tuberculosis in adults due to bovine tuberculosis in the large cities was small (1 to 2 per cent). These rare cases occurred usually in butchers and slaughterhouse workers, that is in people

who had direct contact with bovine tuberculosis. In the rural communities around Amsterdam, however, 14 per cent of the lung tuberculosis in adults was due to bovine tuberculosis; in the rural communities of the rest of the Netherlands this figure was 6 per cent. This difference agreed with the experience that tuberculosis was more widespread among the cattle of North and South Holland than in the rest of the country.

Occurrence of Human and Bovine Tuberculosis in Man in the Netherlands (1937-1939)

	0 - 15 years		15 years & older		
	Human T. B.	Bovine T. B.	Human T. B.	Bovine T. B.	
Towns with more than 100,000 inhabitants	445	46	576	8	Lung tuberculosis
Rest of the Netherlands	206	21	573	45	
Towns with more than 100,000 inhabitants	107	28	200	54	Extra-pulmonary forms of tuberculosis
Rest of the Netherlands	23	18	171	48	

All this probably means that bovine lung tuberculosis in adults is usually due to an inhalation infection caused by contact with tuberculous cattle. The widespread tuberculosis infection among the milch cows of the Netherlands has been commented upon. (I - 5).

The bovine tuberculosis in children and the extra-pulmonary bovine tuberculosis in adults must be connected with

the consumption of raw milk and raw dairy products as buttermilk and so-called "peasant butter." Ten per cent of the milk samples taken on the market of Rotterdam contained tubercle bacilli. The pasteurized milk prepared by the large plants does not contain viable tubercle bacilli, but the milk pasteurized by the small plant is not reliable. In "peasant butter" and buttermilk, tubercle bacilli have been repeatedly found. In case the tuberculosis amongst the cattle in the Netherlands could be eradicated, the human tuberculosis figures would go down to remarkably low levels. In the cattle-raising areas of the country 10-23 per cent of the population drink raw milk, usually from their own cows. In the towns and villages situated in areas where no cattle are raised, raw milk is taken by only a small part of the population.

The anti-tuberculosis campaign dates from 1894 when a central committee was formed for this purpose. The first Dutch sanatorium was not built on Dutch soil but in Davos in the Swiss mountains. Not until 1901 and 1902 were the first sanatoriums built in the Netherlands proper. Since then the anti-tuberculosis campaign has remained mainly a matter of private initiative. There was a Central Society for the Anti-tuberculosis Campaign in the Netherlands (Centrale Vereeniging voor Tuberculose Bestryding) which

took care of the propaganda, instruction of the visiting nurses, and scientific research. Provincial and municipal societies organized the anti-tuberculosis campaigns in their own areas. The Green-White Cross societies actively collaborated with this anti-tuberculosis campaign.

Twenty-eight district tuberculosis bureaus, 110 regional tuberculosis bureaus, and 982 local tuberculosis bureaus were spread over the Netherlands. Here free consultations (57,700 new patients in 1937) and free x-ray examinations were given. These bureaus saw that the patients with tuberculosis were taken care of and that contact investigations in the families were made by the visiting nurses. In most cases, patients with active tuberculosis obtained free treatment, if necessary, in a sanatorium under the existing social security laws.

The role of the Government was limited to a subvention of about one and one-half million guilders per year to this anti-tuberculosis work. A government inspector belonging to the State Public Health Service supervised the anti-tuberculosis work throughout the Netherlands and advised the Government on the ways in which the subvention was to be distributed.

(b.) Smallpox. In 1871, 15,787 people died of smallpox in the Netherlands, but for the last 50 years

this disease has been rare. In 1891 only 10 cases were reported. In and around Amsterdam in 1916, 85 cases (8 deaths) developed due to an ambulant patient with variola from Austria. In 1920, 50 cases (3 deaths) were observed near Arnhem; in 1926, 13 cases (1 death) in South Limburg. A real epidemic occurred in 1929 in Rotterdam (318 cases with 18 deaths) probably due to a harbor infection. In the beginning it was believed that the disease in Rotterdam could be classified as alastrim or variola minor, but in the course of the epidemic the true character of variola major had to be recognized.

The rarity of smallpox in the Netherlands during the last 50 years may well be connected with the widespread vaccination of the whole population. Although the law did not require vaccination of every inhabitant, vaccination was obtained by indirect measures. No child (or teacher) was allowed to go to school unless a certificate of successful vaccination was shown. On the other hand, all children in Holland were obliged by law to go to school for at least six years. This meant that only a few children who received instruction at home - usually because their parents were confirmed opponents of vaccination - could escape this prophylactic measure. Vaccination could also be dispensed with when two physicians certified that this

manipulation would endanger the life of the child, but this was rarely done. Soldiers were revaccinated at the time of induction. The result was that only 7 per cent of the population was not vaccinated. Every community was required by law to provide every three months facilities for vaccination free of cost. The vaccine is produced in institutes at Amsterdam, Rotterdam, and Groningen, which were built, organized, and provided for by non-governmental medical societies but were under state government control.

5. Diseases Causing a High Morbidity and/or Mortality Rate among the Native Population.

(a) Pneumonia is not very frequent in the Netherlands. Pneumonia mortality varies around 50-60 per 100,000. The fatality rate hardly ever exceeds 10 to 12 per cent. Type II pneumo-coccus is remarkably rare. More than half of the cases are caused by Type I, 10 per cent by Type III, 10 per cent by Type V, and 10 per cent by Type VII. The other pneumococcus types are found only sporadically.

Since 1930, cases of psittacosis have been occurring in the Netherlands. In some years even small epidemic outbreaks of this disease have been observed.

(b). Scarlet Fever. Yearly 8,000 to 15,000 cases of scarlet fever occurred. The number of deaths was small and has varied since 1894 between 49 and 84 cases per year.

The disease has been so benign that in 1936 three cities with more than 100,000 inhabitants had no fatal cases; the same held true in 1937 for Rotterdam, Utrecht and Groningen.

(c). Diphtheria. In 1930, 7,450 cases were observed, but in later years the frequency of diphtheria had a tendency to diminish. In 1934, 2,990 cases, in 1935, 1,762 cases; in 1936, 1,544 cases, in 1937, 1,786 cases, in 1938, 1,272, in 1939, 1,273 cases were reported. The fatality varied between 4.5 and 6.9 per cent. Immunization of school children was widespread, but not universal. Since the occupation, the number of diphtheria cases has gone up to 5,437 in 1940; in 1941 to about 19,000 cases.

(d). Epidemic Kerato-conjunctivitis. Epidemics of conjunctivitis caused by Koch-Weeks' bacilli have often been observed. Such an epidemic may incapacitate a considerable number of people, but the dangerous complication of keratitis does not occur in epidemic fashion.

(e). Measles. Measles was a frequent disease, but with a small fatality rate. In 1936, 232 people died from measles, of whom 120 were below two years old and 16 less than ten years. In 1937, 111 deaths from measles were recorded, 54 of whom were below two years; only two of the fatal cases were older than ten years. In 1938, 302 patients died of measles; in 1939 only 47.

(f). Whooping Cough. In 1937, 334 children below ten years died of whooping cough; in 1938, 322; in 1939, 258 children.

6. Miscellaneous Communicable Diseases.

(a). Skin Diseases. Skin diseases are not especially frequent in the Netherlands, apart from favus which occurs in greater numbers in this country than in the neighboring areas. Trichophyton infections, pityriasis versicolor, scabies and pediculosis are seen regularly.

(b). Encephalitis Lethargica. Since the epidemic of 1922, encephalitis lethargica has occurred regularly. For the past 10 years, the yearly number has varied between 29 and 89. The fatality of this disease was high and the number of after-effects considerable.

(c). Helminthiasis.

i. Hookworm. In the coal mines of the Netherlands which are situated in the most remote southernmost corner of the country in South Limburg, ancylostomiasis has been found among the miners. In 1904, 21 per cent of the miners were infected, but in 1908 after an intensive campaign, this figure had dwindled to 2 per cent. In the meantime it appeared that the disease also occurred in about 10 per cent of the brickmakers in South Limburg, especially in those who had worked in Germany. The frequency and the intensity of

the disease is, however, small.

ii. Ascaris lumbricoides and Trichuris trichiura are found in the rural districts. In the very few areas where human fecal material is still used as fertilizer, a frequency of 80 to 90 per cent has been recorded; in the larger cities the figures are only 5 to 10 per cent.

iii. Oxyuris vermicularis is relatively frequent in children.

iv. Strongyloides stercoralis is a rare parasite in the Netherlands and is practically limited to the small group who suffer from ancylostomiasis.

v. Tapeworm Infections. T. saginata is not a rare parasite, but T. solium, which formerly occurred frequently, has practically disappeared in the last 25 years. This must be connected with the strict inspection of pork which has been established in order to prevent Trichinella infections. Dibothriocephalus latus is extremely rare, and the same holds true for Hymenolepis nana. Echinococcosis in humans occurred frequently in Friesland, but sporadically in other parts of the country. The frequency of this disease in Friesland was due to the large number of non-inspected slaughterhouses which formerly were established in this area. Strict supervision has been introduced for the last 30 years, and now the frequency of these parasitic cysts in

cattle and in humans is quickly diminishing.

vi. Trichiniasis. Cases of Trichinella spiralis infection have hardly ever been observed in the last 25 years. Formerly, however, small epidemics were recorded.

(d). Hydrophobia. Rabies is a rare disease in the Netherlands and often years went by in which only one or two patients were sent to the Pasteur Institute in Utrecht for treatment.

(e). Nutritional Diseases. Under normal circumstances, nutritional diseases were practically non-existent in the Netherlands, but during the German occupation, many cases of avitaminosis D have developed. Other avitaminoses must also be present by now. The general under-nutrition has also led to a marked increase in the mortality of different infectious diseases and of infant mortality.

The ground water from the deeper layers in the Netherlands is poor in iodine. This may well explain the frequency of goiter in several areas (Culemborg, Kampen, Breda, Utrecht). The supply systems of these four cities had in later years added appropriate amounts of iodine to the drinking water (about 0.2 mgm. per gallon). In 1939, 283,000 people received iodized water and at that time several other supply systems were seriously considering adoption of this procedure.

(f). Eye Diseases. Formerly, trachoma was a frequent disease among the Jewish population of Amsterdam. It was estimated that in 1910 about 10 per cent of the children of this part of the population were affected. Epidemics of this disease in institutions occurred occasionally. Intensive anti-trachoma campaigns have resulted in a marked decrease of this disease; in 1936, only seven new cases were seen in the special trachoma dispensaries; in 1937 no new case was observed.

(g). Anterior Poliomyelitis. More or less important outbreaks of this disease occur regularly in the Netherlands. In 1930, 599 cases were observed. This number diminished regularly for some years, but whereas in 1937 only 60 cases were reported, in 1938 a new outbreak of 686 cases took place. The fatality is always about 10 per cent.

(h). Leprosy. Apart from a few cases imported from the Netherlands East Indies, leprosy is non-existent in Holland.

(i). Actinomycosis. Cases of ray fungus diseases are seen regularly in the larger hospitals of the Netherlands, - a little more frequently in the rural districts than in the larger cities.

(j). Undulant Fever. Although infectious abortion is frequently found among the cattle in the Netherlands, the

number of cases of undulant fever reported is small and has varied for the last 10 years between 18 and 34 per year. In view of the general interest in this disease found among the staffs of the larger hospitals, the actual number of cases occurring cannot be much larger than the figures reported.

(k). Ratbite Fever. Very occasionally a case of ratbite fever has been observed.

(l). Tetanus. Tetanus is seen occasionally in the larger hospitals, but on the whole is not a frequent disease in the Netherlands.

(m). Anthrax. The veterinary reports mention that even among the cattle, anthrax is not frequent. It occurs only rarely among the human population.

(n.) Glanders. The same remarks as have been made for anthrax hold good for glanders.

e. Sanitation

(1) Departments. The first public water supply in the Netherlands was constructed in 1853 in Amsterdam. In 1884, 12 water supplies were available, taking care of 33 per cent of the total population. In 1895, 36.5 per cent of the population, in 1905, 46.3 per cent, in 1911, 51.8 per cent, in 1924, 66 per cent of the population was connected with reliable water supplies. In 1924, 45 communities used surface water, 78, dune water, and 190, ground water, derived from areas outside the dunes. In 1940, 82 per cent of the population lived in communities with a central water supply and more than 75 per cent of the population was actually provided with piped water by 215 supply systems. All towns with more than 5,000 inhabitants and 830 of the 994 communities with less than 5,000 inhabitants had piped water supplies.

In north Holland, all of the communities and in south Holland, nearly all villages were connected with central water supplies.

The larger communities had their own waterworks but in every province one or two regional waterworks served most of the rural communities. These regional systems were set up by the provincial and local authorities under a concession valid for the whole territory in question. As the authorities did not grant new water concessions to villages in this territory, the latter were compelled to participate in the provincial company in order to obtain reliable water. Existing private undertakings were allowed to continue, but their concessions were gradually purchased by the central regional organizations. All this has been accomplished practically without financial support of the Government, because it could be done on an economic, self-supporting basis. Plans have been made to provide also the remaining isolated communities in the eastern and southern provinces with piped water. The latter plans have already been partly executed with financial help of the Government.

c. Recommendations. -- 1. Water. Water from public supplies present in about 85 per cent of all the cities and communities of the Netherlands, could be used before the war without precautions. As far as is known, normal supervision has not deteriorated too much during the occupation. Ice should be considered unsafe unless delivered by large companies or made at home from piped water. No ice or ice cream should be bought on the streets from small food handlers because of the danger of Salmonella infections.

The Government had organized a Central Institute for Water Supply (Ryks Instituut Voor Drinkwatervoorziening) with its own technical, geological, chemical, bacteriological and economic departments. This institute

advised the Government concerning drinking water problems, planned new water supplies for the Government, and supervised the execution of these plans. It furthermore collaborated, more or less fully according to needs, with the 26 regional drinking water supply systems.

Problems and Control Measures. -- The drinking water problems in the Netherlands present special difficulties. Water can be derived from three sources: (1) from rivers (Rotterdam) and lakes (Groningen, Leeuwarden), (2) from sand dunes, and (3) from ground water outside the sand dunes. A few natural wells are available, limited to a small chalk formation area in South Limburg. Because of widespread pollution, only part of the river water of the Netherlands can be used for drinking water supplies.

In the western provinces, - North Holland, South Holland, and Zeeland, - the main water supplies are found beneath the dunes. In these provinces, most of the surface water is seriously polluted and the ground water full of calcium, iron, manganese and organic matter. Moreover, in North Holland, surface and ground waters are brackish. This explains the widespread use of dune water in this part of the country. Beneath the sand dunes which protect the Netherlands from the North Sea, a fresh water stratum, derived from rain water, is found. There is a superficial and a deep fresh water layer, divided at a level of 60 feet by a layer of clay. The deep fresh water layer floats upon a salt water stratum. Careful investigation has shed light on the diffusion of these fresh and salt water layers and the subterranean currents of the fresh and salt water. The fresh water of the dunes must serve about two million people in the Netherlands; in the future, special measures must be taken lest the dune water supply be exhausted. The dune water has many advantages - it can be transported with-

out difficulty, does not corrode the pipes (not even the old-fashioned lead pipes), is not too hard, and is bacteriologically clean, even without filtration. It often has to be treated for the removal of iron and manganese. Amsterdam in 1853 started with the construction of a dune water supply, and soon den Helder, the Hague, Leiden, Delft, Zaandam, Alkmaar, Haarlem, Velzen, Noordwyk, the Provincial Waterworks of North Holland and different communities on the islands of South Holland and Zeeland followed suit.

The increasing number of water consumers made it necessary to draw not only from the superficial fresh dune water layer, but to use also the deep fresh water layer. In 1937, 14,000,000,000 gallons of dune water were used as drinking water, a quantity larger than the amount of rain which yearly falls on the dunes. This precipitation is the only water which could replace the dune water withdrawn. Besides there is a constant loss of dune water due to the sideways flow towards the North Sea and the adjacent polder land. Amsterdam, for instance, uses 5,700,000,000 gallons of dune water per year, but the dune area from which this water is obtained, receives only 2,640,000,000 gallons of rain yearly. Thus the store of dune water, present in the dune area leased to Amsterdam, diminishes yearly with about 3,000,000,000 gallons. The Hague uses yearly 3,818,000,000 gallons of dune water, although its dune area receives only 2,200,000,000 gallons of rain.

This problem has now become urgent as here and there the chlorine content of the dune water (normally 50mg. per l.) has increased so much that the water could not be used any more. Different solutions have been and will be tried.

Delft and den Helder have given up their dune waterworks; Delft has

combined with the river waterworks of Rotterdam, den Helder with the Provincial Waterworks of North Holland. In 1938 Amsterdam drew, apart from its dune water, 448,000,000 gallons from wells dug in a heather area, 20 miles to the southeast of the city. Furthermore, it used 3,828,000,000 gallons from pools which act as sedimentation basins for the water of the river Vecht. But these quantities are not sufficient as the water consumption increases regularly, while the quantity of dune water used must be reduced to 2,640,000,000 gallons per annum to prevent the water from becoming brackish.

Ever since 1901 the great cities have been considering and studying this problem. Only Leiden has come to a definite decision. The water supply company of this city now irrigates its dune area with water derived from a watershed situated at the foot of the dunes. In the first year (1940-41) about 264,000,000 gallons of water were brought upon Leiden's dune area. In this way the company has been able to stop withdrawal of water from the deep fresh dune water lake below the clay layer. It uses only the superficial fresh water stratum beneath the dunes and still can satisfy its yearly needs of 872,000,000 gallons. Leiden expects to be able to increase this supply easily to 1,320,000,000 and if necessary to 2,346,000,000 gallons. Here, however, circumstances were favorable because a watershed was situated near the dune area. Amsterdam and possibly the Hague will have to go to the far removed Lek river. Amsterdam at least is not inclined to

use the water of the Yssel Lake.

The Ysselmeer is the lake which will remain after the reclaiming of the greatest part of the Zuiderzee has been finished. Originally the Zuiderzee was in free communication with the North Sea. In order to render the reclamation possible, a large dam had to be constructed which now separates the North Sea from the Zuiderzee. Thus, the chlorine content of the Yssel Lake, closed off from the North Sea but the recipient of large amounts of river water, has been decreasing regularly. Whereas the chlorine content of the Zuiderzee water varied between 2,000 and 15,000 mg. per liter, the chlorine content of the Yssel Lake had come down in 1940 to 150-175.mg. per liter and in 1941 to 125 mg. per liter, - a figure compatible with the requirements for a drinking water supply. Continuous care to maintain the composition of the water of the Yssel Lake within these limits will be necessary. The danger that too much salty North Sea water could enter the lake via the large locks or even through leaks in the dividing dam has to be considered. All this has been carefully investigated and the regional Provincial Waterworks of North Holland are ready to use Yssel lake water after prefiltration and slow sand filtration. But Amsterdam has rejected this water, allegedly because the chlorine content is too high and may vary in the future.

Milligrams per Gallon

	Dune Water	River water Rotterdam	Yssel Lake (est. 1950)	Pleistocene Ground Water	
				Superficial	Deep
Cl	137	320	680	44	88
HCO3	1,100	600	720	320	1,200

SO4	100	200	205	28	0
Na	72	185	365	--	--
Ca	360	230	280	--	--
Mg	34	38	54	--	--
Organic material (KmnO4)	55	56	--	8	120
Iodine	0.0075-0.11 mg. per gal.	--	--	--	--

Rotterdam, situated on the Maas, uses filtered river water. The annual consumption of Rotterdam proper in 1938 amounted to 8,140,000,000 gallons. In the central and eastern part of the Netherlands, large sandy areas are covered by heather or by woods. Here the pleistocene sand and gravel are protected by a layer of clay. The ground water can be used for drinking water, often after purification, sometimes even without purification. (Arnhem, Utrecht, Nymegen). Usually the superficial phreatic gound water layers can be used, but sometimes the deeper layers of the ground water must be employed. At Nymegen and in southeastern Friesland, the subterranean water galleries and wells go down to 270 feet.

The purification of water in the Netherlands consists mainly of sedimentation, prefiltration through gravel (about 65 cm. per hour) and slow filtration (about 10 cm. per hour). Chlorination of the water is nearly always considered to be superfluous. Only a few small water plants use chlorination. Many large factories, especially in the eastern part of the Netherlands, have their own water supplies for their engine rooms. This is different from other countries where industrial enterprises use enormous amounts of water furnished from the general drinking water supplies. This partly explains why the average water consumption per capita in the Netherlands was smaller than in other countries.

Daily per Capita Consumption of Water
In Gallons

	1921	1936	1937	1938	1940
Amersfoort	19	-	-	-	-
Amsterdam	-	-	32.7	-	32.1*
Arnhem	18.9	-	-	-	-
Delft	-	-	-	-	11.7
Dortrecht	-	-	-	-	39.6
Eindhoven	-	-	-	-	12.4
Gouda	-	-	-	-	25.3
Provincial supply of N. Holland	-	-	-	-	23.8
Haarlem	15.5	11.3	-	-	11.7
The Hague	20.0	-	-	-	17.8
Leiden	-	-	-	-	28.2
Nymegen	23.5	-	-	-	-
Rotterdam	31.0	-	-	36.7	36.4
Utrecht	17.8	-	-	-	-

*After deduction of the water used by industry, only 23.3 g.p.d. per person.

AMSTERDAM
1938

Domestic use	6,900,000,000 g. per yr.
Industrial use	1,800,000,000 g. per yr.
Public works	330,000,000 g. per yr.
Supply outside Amsterdam	740,000,000 g. per yr.
Leakage.	264,000,000 g. per yr.

The widespread introduction of water meters and the improvement of the grade of service pipes have restricted water losses and leakage. This may explain why, for instance, in Rotterdam the daily per capita water consumption has decreased from 58 gal. in 1893 to about 26 in 1910; in The Hague from 26.4 gal. in 1898 to 17.8 in 1940. But the main reason for the small consumption of water per capita in the Netherlands is the relative scarcity of bathing facilities. In 1936 even Amsterdam had only one bath tub per 24.3

and one shower per 67.4 inhabitants. These data as to daily water consumption are seen in their proper perspective when it is realized that in houses with flush toilets where every inhabitant takes only one bath per week, the water consumption amounts to about 18.5 gallons per person per day.

Sewage. The difficulties of the removal of sewage in the Netherlands are of a special kind, because 38 per cent of the country is situated below sea level and 20 per cent of its 12,600 square miles of surface consists of water. The population is very dense, averaging 675 per sq. mi. with a maximum of 2,000 in the western part of the country. In 1920 a central State Institute for Sewage Purification (Rijksinstituut voor de Zuivering van Afvalwater) was established, which has given general guidance for the handling of these problems. The Institute took an active part in the design, operation, and research for sewerage systems, storm-water outlets, and purification plants. It had its own chemical and biological laboratory for the study of the purity or pollution of the surface water. The work of the Institute had expanded considerably because the marked increase of drinking water supplies had acted like a double-edged sword. On one hand it had increased the quantity of sewage which had to be disposed of; on the other hand, more clean surface water was required and extra care against water pollution was necessary.

The major part of the pollution is due to the sewage and factory wastes of the Netherlands itself, a smaller part to the neighboring countries. The Rhine water is still polluted when it

arrives in the Netherlands due to the sewage and factory wastes of the Ruhr area and other localities in Germany. This pollution is regularly found by the laboratory of the Waterworks of Amsterdam at Rhenen on the Rhine, although the distance between laboratory and source of pollution is about 100 miles and the average flow of the Rhine amounts to 66,840 cubic feet per second. The water of the Rhine near the German border always contains B. coli in 1 cc. of water, nearly always in 0.1 cc., usually in 0.01 cc., often in 0.001 cc., and occasionally in 0.0001 cc. Due to slow but effective biological self-purification, the river water downstream becomes less contaminated. International treaties will be necessary to protect the surface water supplies of the Netherlands, situated as the country is at the mouth of two large rivers (Rhine and Maas) which function as the "cloacae" of Western Europe. Biological self-purification in the Ysselmeer easily takes care of the sewage that it receives from 500,000 inhabitants of Amsterdam and from 90,000 inhabitants of other cities. The same can be said of the impurities of the water of the river Yssel, the main fresh water supply of the Yssel Lake.

Until recently, the sewer systems of practically all cities opened directly into rivers or lakes. Unfortunately, the biological self-purification of water needs large surfaces, slow currents, and regular oscillating movement by wave action. Quickly running rivers spread contamination over great distances (Rhine). Most of the rivers of the Netherlands are too narrow for efficient self-purification, and much of the surface water has been badly polluted

by sewage as shown by the following example: for a distance of 15 miles below the place where the city of Utrecht discharged its sewage and wastes into the river Vecht, no fish could live.

In the rural communities conditions were still worse, as privies were mostly built over ditches and brooks. Many cesspools and septic tanks were found which contributed to the pollution of the soil.

In recent years plants for the purification of sewage had been installed in several places in order to prevent further pollution. The little community of Bussum southeast of Amsterdam was the first to provide for the purification of its wastes. The city of Tilburg had several irrigation fields for biological purification, which took care of about two-thirds of the sewage of the city. The rest was purified chemically, mainly by precipitation with alum. The city of Hilversum had had irrigation fields for 25 years, but has recently installed activated sludge plants. The city of Utrecht and the city of Leiden had also lately installed a purification plant, as had Haarlem, Vucht, Zaandam, Lochem, Borculo, Eibergen, Groenlo and Winterswyk. Rotterdam discharged its sewage into the river Maas, which near Rotterdam is very broad; the biological purification is quite effective here. The Hague discharged its sewage into the North Sea near the sea-bathing resort of Scheveningen. In order to prevent pollution, the discharge conduit opened into the sea 500 yards from the coast. The mouth of this conduit had a special construction by which the contents of the sewers were mixed rapidly with the sea water. Be-

fore this construction was made, the city sewage mixed poorly with the sea water, leading to undesirable conditions in the bathing area.

The oldest part of Amsterdam has for many years discharged its sewers into its many picturesque city canals, which communicate with the Zuiderzee. At night the locks were opened, whereby the canals were flushed with Zuiderzee water. Since the Zuiderzee has been closed off from the North Sea, this flushing of the canals has to be done with water drawn from the Ysselmeer by steam pumps, because the level of this lake is much lower than that of the original Zuiderzee. Since 1935 the sewers of this oldest part of the city have been connected with the central sewer which discharges the sewage of the main part of the newer city areas via a large conduit into the Zuiderzee, now the Ysselmeer. The opening of this conduit was three miles off the coast. The hygienists of Amsterdam were emphatic that the biological purification of the Yssel Lake was so active that a few hundred yards removed from the opening, - which yearly discharged 41,000,000 cubic meters of sewage produced by 500,000 inhabitants of Amsterdam, - no contamination of the water of the lake could be detected. This may explain why the water of the Ysselmeer has been generally accepted as a source for drinking water supplies. Two parts of Amsterdam, the lowest situated 12 to 15 feet below sea level, and the newest part had sewage purification plants. Sedimentation tanks and oxidation beds were used for one part, an activated sludge plant for the other.

The contamination of surface water by the sewage of a village

is usually insignificant compared with the polluting influence of the wastes of the dairy plant of the village. More and more dairies, slaughter-houses, and plants producing strawboard, potato flour, beet sugar, and maize starch, were erecting clarification and purification installations. Whereas biological purification may or may not take care of sewage, the chemical contamination by factory wastes required a purification plant. In total, about one hundred purification plants were in operation in the Netherlands, most of them small ones, used by industrial establishments. There was, however, a definite tendency to use more and more purification installations also for city sewage.

(d) Food and Dairy Products in Relation to Health.

Before the war the food situation in Holland was remarkably favorable. The energy value of the daily food consumption per capita amounted to 2,640 calories in 1938. The caloric intake of the adult male must thus have been about 3,200 calories, a value which was also found in many menu investigations which have been performed all over Holland. Even the less prosperous minor employees in the small cities had a daily intake of about 100 grams of proteins and 150 grams of fats per person, and workers earning less than 1,400 guilders a year (purchasing value about $1,400) ate daily 100 gms. of protein and 118 gms.

of fat. The social security laws in the Netherlands were so carefully devised that between 1930 and 1938, a period of severe economic depression with widespread unemployment, the food situation of the unemployed was not unfavorable, as shown by menu surveys among 700 families of the unemployed. Furthermore, neither the general mortality nor the tuberculosis mortality increased in this eight-year period of unemployment. All this was possible because the Netherlands produced large amounts of butter, cheese, eggs, margarine, condensed milk, pork, vegetable oils, sugar, vegetables, and fruits - much more than was necessary for local consumption. These articles were important items for export. Wheat, maize, coal and coffee were the principal imports. Large herds of cattle found excellent grazing on the polders, and in 1938 1,500,000 milch cows, 1,100,000 young cattle and 200,000 other cattle and bulls were present in the Netherlands. The number of pigs was 1,538,000; of chickens, nearly 35,000,000. The annual milk production was 5,000,000,000 kg. It follows that nutritional diseases, as avitaminosis B and hunger edema, were the greatest rarities in the Netherlands.

Refrigeration facilities were plentiful in the larger cities and also in the areas where cattle were slaughtered for export.

The occupation has had a disastrous effect on nutrition in the Netherlands. The number of pigs went down in 1942 to 490,000. During the first week of the occupation, Germany removed 70,000,000 pounds of butter, about 90 per cent of the total reserves. Pastures had to be plowed up for conversion to oil seed cultivation in order to supply feed for the German diet. It is estimated that at least one-fourth of Holland's cows had been slaughtered by the end of 1942. In September 1942 the energy value of the legal food ration per normal consumer per day was 1,570 calories, in November 1942, 1,500 calories. The shortages were greatest in the protective foods. In September 1942 the amount of fat in the legal ration was 76 per cent below standard, total protein 43 per cent, animal protein 80 per cent, calcium 76 per cent, Vitamin A 48 per cent, Vitamin D 48 per cent, Vitamin B1, 37 per cent, and Vitamin C, 13 per cent. It was inevitable that nutritional deficiencies verging on actual starvation were developing.

(e) Insects and Animals of Importance to Man and Their Control. --a. Vectors of Disease. -- (1) Mosquitoes. -- Anopheles. In the Netherlands A. labranchiae atroparvus, A. messeae, A. maculipennis, A. plumbeus, and A. claviger are found. The latter two are not malaria vectors. A. maculipennis is found in small numbers in the eastern provinces of the Netherlands. A. atroparvus and A. messeae are widely spread. A. atroparvus is mainly found in North Holland, Zeeland, Friesland and some areas of Groningen; A. messeae in South Holland and Utrecht and some of the eastern provinces. The density of either A. atroparvus or A. messeae is great only in North Holland, South Holland, Zeeland and some areas of the northern provinces. A. atroparvus is present in large numbers in areas where the water is brackish (salinity of 0.16 per cent of NaCl or higher). Although A. messeae has been found to be infected in very rare cases, A. atroparvus is the only effective vector in the Netherlands, and malaria is present only in areas with a dense A. atroparvus population. Of A. atroparvus caught in human habitations in malarious areas, 5.58 per cent were infected during August and September; for A. messeae the same figure was only 0.04 per cent. A. atroparvus becomes infected after the sexual activity, which takes place between July 1 and August 15, has ceased. Between August 15 and the end of December, A. atroparvus, containing large amounts of normal sporozoites, are caught in considerable numbers. Between January and the end of April, A. atroparvus still contains sporozoites but the latter are degenerated and do not transmit the infection. Between May and August, A. atroparvus does not contain either normal or degenerated sporozoites. A. atroparvus shows strong stabular deviation. In one village north of Amsterdam, the

average number of A. atroparvus caught per house was 22, per stable 9,592. In Amsterdam these figures were 15 and 3,794. But the infected specimens of A. atroparvus are caught in the houses, not in the stables. Of the stable population, only 0.03 per cent were infected (to be compared with 5.58 per cent natural infection of mosquitoes caught in the houses). A. atroparvus attacks its victims in the houses, especially in the bedrooms and only seldom in the open. When winter comes, A. atroparvus hibernates in the houses and thus survives.

The breeding places of A. atroparvus are chiefly narrow ditches (not wider than 3 yards). The vegetation of the water must be "horizontal" and must be floating just below the surface of the water; the presence of algae and of narrow-leaved phanerogamous plants favors the development of A. atroparvus. In ditches, however, with a horizontal vegetation floating on the water surface (water lilies, duckweed) or in ditches with a vertical vegetation (reeds and rushes), A. atroparvus does not breed. Absence of vegetation usually means absence of A. atroparvus. In swamps or lakes the A. atroparvus does not breed.

In the Netherlands the notion that swamps and lakes cause a region to be malarious is not correct. On the contrary, the reclamation of swamps and lakes, as has been done in the Netherlands, increases the "malariousness" of the country, because the reclaimed soil is intersected by narrow ditches. Besides, the removal of large amounts of surface water causes an infiltration with the brackish water of the lower layers of the soil. The reclamation of the large areas of the Zuiderzee did not give rise to malaria immediately, because the water was still too salty. After a few years, however, the salt content of the ditches had reached

the level of the water of the rest of North Holland, and a malaria epidemic set in.

Different methods of malaria control have been tried in North Holland. Species sanitation here had to take into account:

1. The preference of A. atroparvus for salty water.
2. The gathering of A. atroparvus in great numbers in human habitations by the time sexual inactivity commences.
3. The importance of "healthy" carriers for the anopheline infection.
4. The habit of A. atroparvus to take short flights during the time of the most frequent anopheline infection.

Dusting with Paris green and oiling with spindle oil have been tried. These methods are, however, expensive and have to be applied over very large areas at the same time because of the long flights of which A. atroparvus is capable. Whereas the average flight of this mosquito does not exceed two miles, in the flat areas of Holland the wind may carry A. atroparvus over a distance of 8 miles. The latter fact has wrecked a good deal of the results of the oiling and dusting. Wholesale destruction of A. atroparvus by killing the hibernating adults in stables has not been successful. In the beginning, houses were not included in this campaign, because the 3 per cent lysol solution which was used spoils the furniture. Catching of the hibernating mosquitoes with the vacum cleaner has not this disadvantage, but does not reach the hidden corners which the hibernating mosquitoes frecuent.

Later destruction of the living A. atroparvus during its period of infection was tried. Between August 1 and November 1, the houses with more than four children, that is, the houses which probably harbor

healthy carriers, were sprayed every two weeks with pyrethrum dissolved in white kerosene. The results of this campaign were very encouraging and evidently reduced the malaria incidence for the next year. Still, spraying only hides the intrinsic "malariousness" of the country and does not touch the source, that is, the presence of large numbers of A. atroparvus. It is commonly held that the only way in which the latter can be remedied will be by freshening the brackish water of North Holland. It is hoped that this will result from the freshening of the water of the Yssel Lake which remained after the Zuiderzee was closed off from the North Sea.

By 1941 the chlorine content of part of the surface water of North Holland had already decreased considerably.

(ii) Aedes. Aedes cinereus is a common mosquito in the Netherlands. It is practically always harmless, but in 1936 swarms of this mosquito suddenly appeared in one area and caused many cases of skin affection resulting from its bite. Aedes aegypti and A. albopictus have never been observed in the Netherlands.

(iii) Culex -- Others. The most common mosquito is the C. pipiens. C. annulatus, C. dorsalis, C. annulipes, C. cantans, and C. nemorosus are also widespread. After the salty Zuiderzee had been transformed into the fresh Yssel Lake, a mosquito plague due to Tendipes plumosus had developed, especially in the neighborhood of the dam in the northern part of the Yssel Lake and in the surrounding regions. Very bad years were 1936, 1937, 1940, and 1941. In 1938 and 1939 many less mosquitoes were found. Fortunately, this mosquito is not a malaria carrier.

(2) Lice. Pediculus vestimenti, P. capitis, and Phthirus

pubis all occur in the Netherlands. Widespread personal hygiene has, however, so reduced the frequency of these parasites that body and head lice had, at least in the larger cities, become rare before the war. It may be assumed that the infestation rate has greatly increased, however, since the German occupation.

(3) Flies. The common house flies are the Musca domestica and M. corvina. The former especially may serve as a mechanical transmitter of disease.

(4) Sandflies. Although many innocent kinds of sandflies occur in the Netherlands, Phlebotomus has never been observed.

(5) Other Flies. Tabanus bovinus, T. autumnalis, T. bromius, and T. tropicus, Chrysops relictus and Stomoxys calcitrans are common flies which occasionally attack man. The same holds true for Simulia maculata. Curysomyia formosa, Calliphora erythrocephala, Lucilia caesar, Sarcophaga carnaria also are frequent; they all have the habits of house flies and may be of medical importance.

(6) Ticks. Ixodes ricinus is the vector of Babesia bovis in the Netherlands.

(7) Fleas. Pulex irritans is the common flea, but the X. cheopis has been found in Amsterdam. Ceratophyllus fasciatus, the European rat flea, is not uncommon.

(8) Rodents. In the Netherlands, Rattus norvegicus has overgrown the R. rattus population. The latter kind is found only in a few limited areas of the inner city of Amsterdam.

(9) Mites. The Sarcoptes scabiei occurs in the Netherlands. The less soap is available, the more frequently scabies is found. Sarcoptes minor, a parasite of the cat, may also attack man.

(10) Bedbugs. Cimex lectularius is found in certain houses, but

not too frequently. It is said that the related bug of swallows and pigeons (Cimex hirundinis, Cimex columbarius) also occasionally infests human beings.

b. Poisonous Animals. Only one poisonous snake, the Viper berus, is known to occur in the Netherlands. It is rare and is found only in the sandy areas of the eastern provinces. Other dangerous animals do not occur.

c. Pests. Apart from the mosquitoes on and near the Yssel Lake and occasional swarms of Aedes cinereus, the only pests to be mentioned are the cockroaches which are frequent in bakeries and in some old houses.

d. Poisonous Plants and Foods. Among many edible and tasty mushrooms occasional poisonous ones occur. as Amanita phalloides, Amanita pantherina, Amanita muscaria, Inocybe geophylla, Hypholoma sublateritium. Other plants which may exceptionally give rise to poisoning are Juniperus sabina, Aconitum napellus, Cicuta virosa, Conium maculatum, Hyoscyamus niger, and Datura Stramonium.

(f.) Miscellaneous Problems of Sanitation.

The vital statistics of the Netherlands showed a favorable situation, although the birth rate had been going down continuously until it reached 19.9 per 1,000 inhabitants in 1938. The total mortality, however, was so low (8.73, 8.68, 8.80, 8.90 in 1935, 1936, 1937 and 1938, respectively) that a considerable birth excess resulted. The population has been increasing continuously from 5,100,000 in 1900 to 7,900,000 in 1930 and 8,200,000 in 1938. Part of this increase of the population can be absorbed by the "twelfth province" which will result from the partial reclamation of the Zuiderzee. These plans when fulfilled will ultimately lead to an increase of 550,000 acres of Dutch soil, that is, 16 per cent of the present arable surface of the Netherlands. One part of the reclamation (50,000 acres) has been finished. The second part (120,000 acres) of the plan was in full execution when the occupation took place.

Infant mortality below one year had gone down in 1937 to 38.1 per thousand live births. The neonatal mortality rate, that is, the mortality of children less than one month old, 21.6 per thousand live births in 1936, was claimed to be the lowest figure in the world. The Dutch public health authorities were of the opinion that a further decrease of the total mortality could not be expected. This meant that if the number of births remained on the decrease, a decrease of the birth excess must necessarily result.

A housing law of 1901 declared that the Government accepted the responsibility for the improvement of the habitations of the population. The implementation of this law was the duty of the municipalities, but a special branch of the State Public Health Service was organized for the supervision of this program, consisting of one chief inspector, 10 inspectors and a corps of technicians. As the registration of houses and their occupants was compulsory, the inspectors could at any time discover any overcrowding in their districts.

Thus the housing situation had become favorable. The Government and the municipalities had contributed liberally to societies and companies for the improvement of housing facilities. Between 1920 and 1923, 88,000 houses were built with Government assistance, between 1923 and 1937 another

106,000. The result was that even workmen with low income could rent for a small amount of money modern little houses with hygienic facilities, built with financial assistance of the municipality.

In the rural districts these problems were more difficult to solve. Special assistance was provided for the agricultural laborer who lived in a suitable house that had been found for him. He then had to pay a rent equal to only an eighth or a sixth of his wages instead of the customary one-fourth or even one-third part. Most of the dwellings in the rural areas contained three rooms, - kitchen-living-room and two bedrooms. Large families in the rural part of the country could also have a fourth room without much increase in rent. Even in communities with less than 10,000 inhabitants the proportion of houses with three or more habitable rooms was 36 per cent in 1899, 45 per cent in 1909, and 71 per cent in 1930.

The new villages which have been built recently in newly reclaimed polders have broad highways with footpaths and turf strips, stone gutters, piped drinking water and sewerage. The clean personal habits of the Netherlanders were a favorable public health factor. The streets and houses were kept scrupulously clean; in some of the large cities it was a jail offense to deposit rubbish or to spit on the streets. The absence of illiteracy facilitated the introduction of modern

public health measures.

It is almost unnecessary to say that the structure of the public health service must have been damaged considerably by the German occupation and that the actual figures on the occurrence of different diseases are much less favorable in 1942, often even disquieting. The rate of mortality increased 9 per cent in 1940, and 17 per cent in 1941 (as compared with 1939). The greatest increase took place in the adolescent group (from 14 years to adult age) where mortality in 1941 increased 43 per cent as compared with 1939. Victims of actual warfare are not included in these figures.

f. Veterinary diseases were not frequent and were kept well in check by the veterinary service, but a certain amount of actinomycosis, coli bacillosis, paratyphoid, glanders, distomatosis and piroplasmosis occurred. Cysticercus inermis was not rare, and epidemics of foot and mouth disease occurred from time to time (a severe epidemic raged in 1937). Infectious abortion, on the other hand, was frequent. On 11,260 famrs with 170,000 head of cattle, 7.8 per cent of the cows suffered from infectious abortion. Samples of milk sold on the market in Utrecht showed the presence of Brucellae in 46 per cent; in Amsterdam this figure was found to be 37 per cent.

The greatest danger to human health was found in the widespread bovine tuberculosis. The disease is especially frequent among the cattle of North and South Holland, the centers of production of milk to be sold for consumption as such. In Friesland the cattle was much healthier, but here only small amounts of molk were used for local consumption; the largest part of this milk went to the factories where it was processed under rigorous hygienic measures. The bovine tuberculosis campaign started in 1905, but only in later years has a certain amount of success been attained. The campaign was mainly left to private initiative; the Government gave financial support and a Government inspector was appointed to help and supervise the campaign. Since 1938 every cattle raiser who produced milk for human consumption has been obliged to participate in the anti-tuberculosis campaign. This implies annual examination and tuberculinization of all cows. Cows with open tuberculosis are slaughtered; cows with positive tuberculosis reactions but without open tuberculosis must carry a special mark. Until 1938 the owners of only 400,000 milch cows were members of the anti-tuberculosis campaign and even a considerable part of their cattle was tuberculous. The owners of the rest of the milch cows (one million) were not in the campaign.

Fortunately the custom of boiling milk or pasteurizing

it is widespread in the Netherlands. Even so, undulant fever occurred and bovine tuberculosis was frequent among the population, due largely to the fact that part of the rural population drinks raw milk, usually from its own cows, and prepares its own butter from raw milk (peasant butter).

Everywhere in Holland the meat inspection was strict. There were numerous municipal slaughterhouses which had to satisfy special regulations set up by the Government and were regularly inspected by Government inspectors. Apart from this, there were 90 governmental meat inspection stations which specially supervised the meat slaughtered for export.

g. Laws. In 1928 the law requiring a vaccination certificate for all children who had to go to school, was suspended. Since then, the general immunity of the population has decreased rapidly. The reason for this suspension is found in the occurrence of encephalitis after vaccination, first described in the Netherlands in 1925. This disease has a fatality rate of 30 per cent, and 6 to 10 per cent of the patients who recover have residual signs. That the fear of vaccination encephalitis is not imaginary was shown in 1929 during the epidemic in Rotterdam. Then more than 1,500,000 vaccinations and revaccinations were performed all over the Netherlands: 56 cases of encephalitis occurred after first vaccination, 26 after revaccination.

In Holland every year 160,000 children were born. In 1924, 155,000 vaccinations were performed, but since 1928 this figure has rapidly decreased; in 1938 only 20,833 people were vaccinated. The

fear of encephalitis has frightened physicians and parents and now only 20 per cent of the school-children are vaccinated; in 1936, 1,500,000 children below 6 years were not vaccinated. As 80 per cent of the population should be vaccinated in order to obtain a satisfactory immunity of the population, import of smallpox in the Netherlands may now well result in a serious epidemic.

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Water Supply Systems *

Amsterdam: (1940). Municipal -
a. 249 wells about 131 feet deep in dune area; annual supply 6,600,000,000 g.
b. Shallow wells near Hilversum (heather area); annual supply 448,000,000 g.
c. Surface water from the Loenerveen pools which act as sedimentation basins for water from the river Vecht; if necessary the excess water from the adjacent Bethune polder is pumped over into the Loenerveen pools; annual supply 3,828,000,000 g. Slow sand filtration and aeration to remove manganese. One reservoir; capacity 2,600,000 g. Annual consumption 23.2 g.p.c.p.d. after deduction of water used by industry.

Apeldoorn: (1929). Municipal - 12 wells 82 to 157 feet deep; no treatment; two tanks; total capacity 211,000 gallons. Consumption 9.5 g.p.c.p.d.

Arnhem: (1929). Private (Arnhemsche Waterleiding Mij): 94 wells, 33 to 230 feet deep; no treatment; one reservoir and one water tower; total capacity 449,000 g. Consumption 20 g.p.c.p.d.

Dordrecht: (1929). Municipal - surface waters; slow sand filtration; one water tower; capacity 132,000 g. Consumption 30 g.p.c.p.d.

Eindhoven: (1929). Municipal - 16 wells 115 feet deep; slow sand filtration; one water tower and one reservoir; total capacity 370,000 g. Consumption 13 g.p.c.p.d. 0.05 mgm. iodine per l. water is added.

Enschede: (1929). Municipal - 60 wells 39 to 49 feet deep; slow sand filtration; one water tower; capacity 160,000 g. Consumption 15 g.p.c.p.d.

Groningen: (1929 1936). Municipal - 22 wells about 197 feet deep, and river water; aeration, Ca $(OH)_2$ sedimentation, rapid sand and slow sand filtration; three water towers; total capacity 442,000 g. Annual supply 937,000,000 gallons.

Haarlem: (1929). Municipal - 340 wells about 49 feet deep; slow sand filtration; one water tower with a capacity of 317,000 g. 15.6 g.p.c.p.d. in 1921; 11.3 g.p.c.p.d. in 1936.

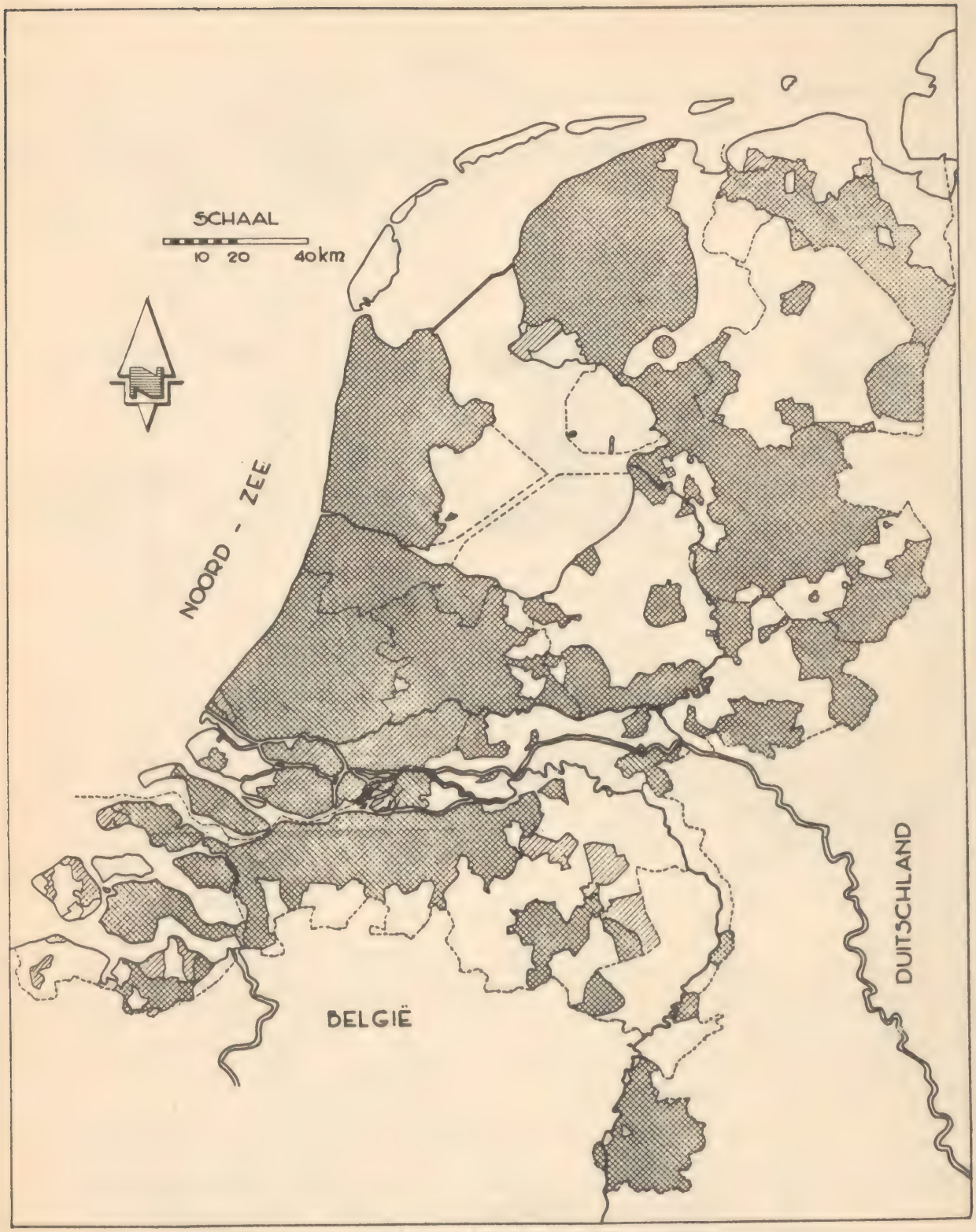
Hilversum:	(1929).	Private (Utrechtsche Waterleiding Mij); 36 wells 43 to 79 feet deep; no treatment; one water tower; capacity 159,000 g. Consumption about 100 g.p.c.p.d.
Leiden:	(1941).	Private (N.V. Leidsche Duinwater Maatschappy); dune water; slow sand filtration. Since 1940 dunes are irrigated with 264,200,000 g. fresh surface water derived from a nearby watershed; annual consumption 792,600,000 g.(28.2 g.p.c.p.d.)
Maastricht:	(1929).	Municipal - 2 wells 28 feet deep and one well 33 feet deep connected with infiltration gallery; no treatment; one tank holding 108,000 g.; consumption 22 g.p.c.p.d.
Nijmegen:	(1929).	Municipal - 45 wells 197 to 230 feet deep in Kronenburgpark; no treatment; two natural reservoirs; combined capacity 793,000 g. Consumption 23 g.p.c.p.d.
Rotterdam:	(1929).	Municipal - Maas River water; prefiltration through gravel (65 cm. p. h.) followed by slow sand filtration (10 cm. p. h.); one reservoir and two water towers. Combined capacity 2,600,000 g. Total consumption: (1938) Rotterdam proper, 8,140,000,000 g. per year (36.7 g.p.c.p.d.); Rotterdam, with suburbs, 9,440,600,000 g. per year.
The Hague:	(1940).	Municipal - dune water. Total consumption 3,818,000,000 g. per year (17.8 g.p.c.p.d.).
Tilburg:	(1929, 1938).	Private (Tilburgsche Waterleiding Mij); 60 wells 82 feet deep; rapid sand filtration and aeration. Total reservoir capacity 423,000 g. Consumption 27 g.p.c.p.d. of which nearly 60% is used for industrial purposes.

* g.p.c.p.d. = gallons per caput per diem.

Fig.1.


SITUATION
TOPOGRAFIQUE
DES PAYS BAS.
40 KM.
N.
MER DU NORD
GRONINGUE
GRONINGUE
LEEUWARDEN
FRISE.
ASSEN
DRENTHE
+80
HOLLANDE SEPTENTRIONALE
ZUIDERZÉE
ZWOLLE
OVERIJSSEL
+70
+40
+80
HAARLEM
AMSTERDAM
UTRECHT
AMERSFOODT
+80
+70
+100
+30
+50
GUELDRE.
LA HAYE
HOLLANDE MERIDIONALE
UTRECHT
ARNHEM
ROTTERDAM
+100
+20
NIMÈGUE
LA MEUSE
LE RHIN
ALLEMAGNE
BOIS LE DUC
MIDDELB.
ZÉLANDE
BRABANT SEPTENTRIONAL
L'ESCAUT
BELGIQUE
LIMBOURG
MAESTRICHT
+150
+190
+230
+320
Dunes
Hills
Reclaimed land (Polders)
All country west of this line less than 3 ft. above low tide level of the harbor of Amsterdam.

Fig. 1. Drinkwater supply systems in the Netherlands in 1924.
● Cities and villages with local water supply.
▨ Regional water supply systems.
From Krul W.F.J.M.: La Distribution De L'Eau Potable Dans Les Pays-Bas. In L'Organisation Sanitaire des Pays-Bas. Societe Des Nations 1924, p.222-250.



Drinkwater supplies in the Netherlands in 1938.

////: Piped-water supply.

Fig.3

Fig.4. Geographical distribution of A. labranchiae atroparvus (black dots) and A. messeae (white dots). The Atroparvus area moreover is darkly shaded and the Messeae area lightly.

From Swellengrebel N.H. & DeBuck A. Malaria In The Netherlands, 1938, p.68

Fig. 5. The Anopheline density in the greater part of the Netherlands.
Black:400 Anophelines per stable or over.
Darkly shaded:100-400 Anophelines per stable.
From Swellengrebel N.H. & DeBuck A.
Malaria in the Netherlands, 1938, p.71

Fig.6. Distribution through the Netherlands of water with a NaCl-content of 0.16% or more (black dots) and of water of a lower salinity (white dots).

From Swellengrebel N.H.& DeBuck A. Malaria In The Netherlands, 1938, p.69

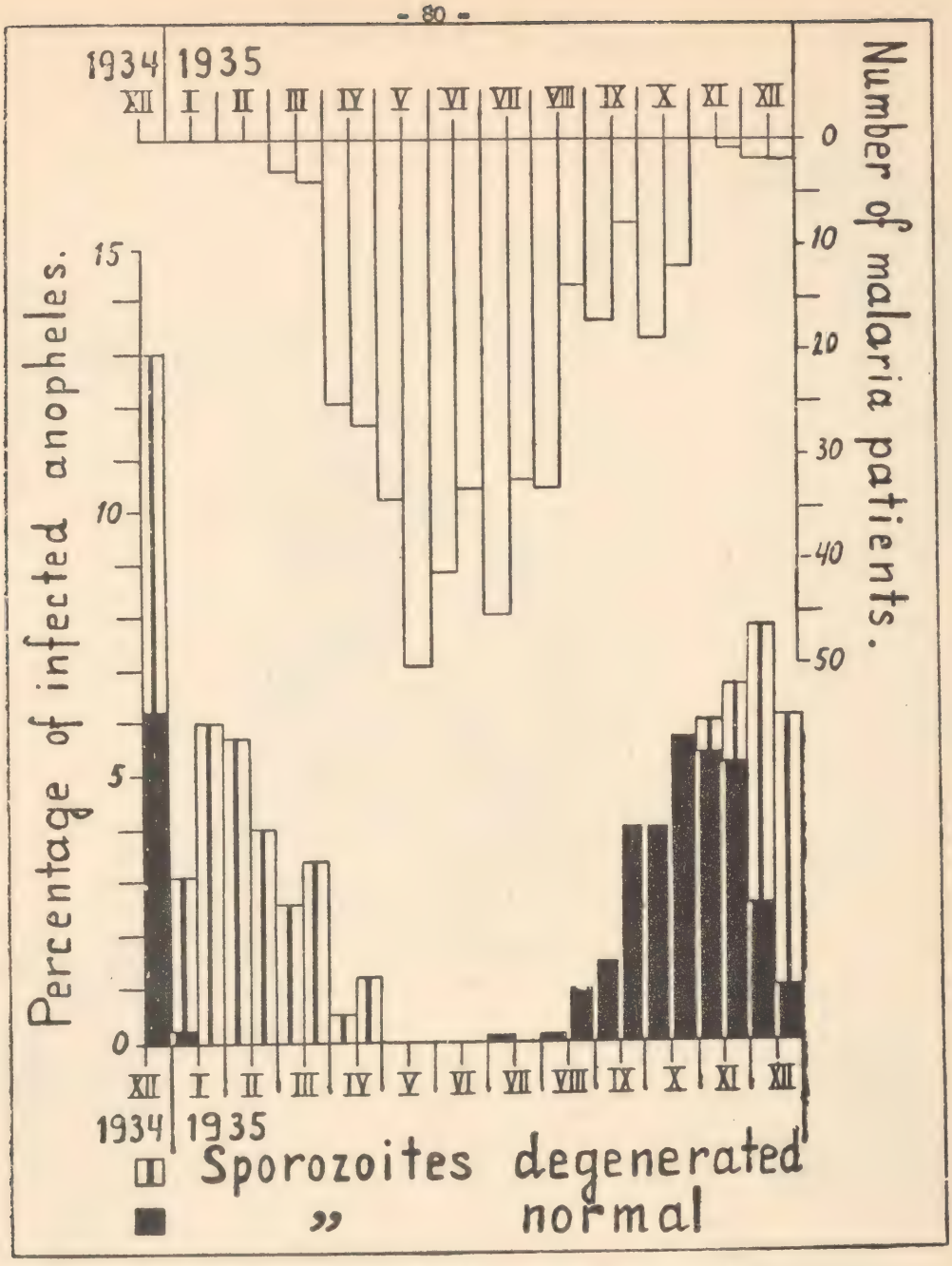


Fig.7. Seasonal variation of the sporozoite-rate compared with the seasonal variation of the number of malaria patients. Columns pointing upwards: Half-monthly incidence of anopheline infection (sporozoites only) as observed in 1935, mainly in Uitgeest. Black columns: percentage of anopheles carrying sporozoites the large majority of which are normal. White columns with a black vertical bar: percentage of anopheles carrying sporozoites the large majority of which are degenerated. Columns pointing downwards: Half-monthly number of persons having suffered from malaria in 1935 in the village of Uitgeest. Each person is counted once only, the first time he had malaria that year.

From Swellengrebel N.H. & DeBuck A. Malaria In The Netherlands, 1938, p.129

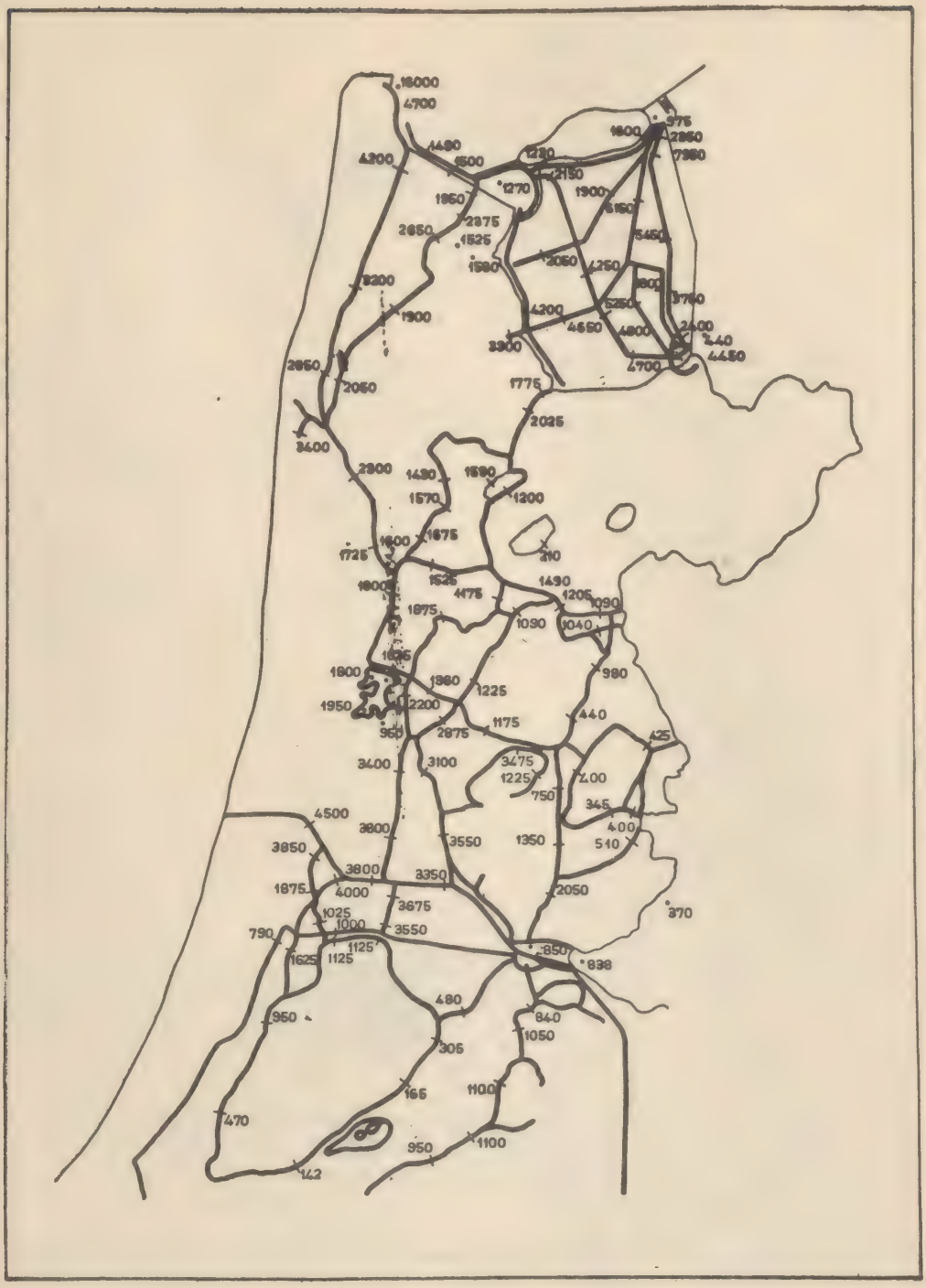


Fig.8. Chlorine content in MGM per liter of the surface water in North Holland on July 30th 1936.

From Wibaut-Isebree Moens N. L.:
Zoutgehalte Van Boezem En Polderwater in Noord-Holland.
Water, Bodem, Lucht 27: 19-26, 1937.

RESTRICTED

Fig.9. Dissemination of frankly intermittent tertian fevers through the Netherlands in 1875. The black dots indicate places where such fevers were recorded in great quantities. From unpublished reports.Frm Swellengrebel H.H.&Debuck A. Malaria in the netherlands,1938,P24

Fig. 10. Dissemination of malaria through the Netherlands in 1919. The black dots indicate where much malaria was recorded(from the report of the Central Sanitary Council 1920; corrected by subsequent findings)Frm.Serllengrebel H.H.&DeBuck A. Malaria in the Netherlamis,1938.P25

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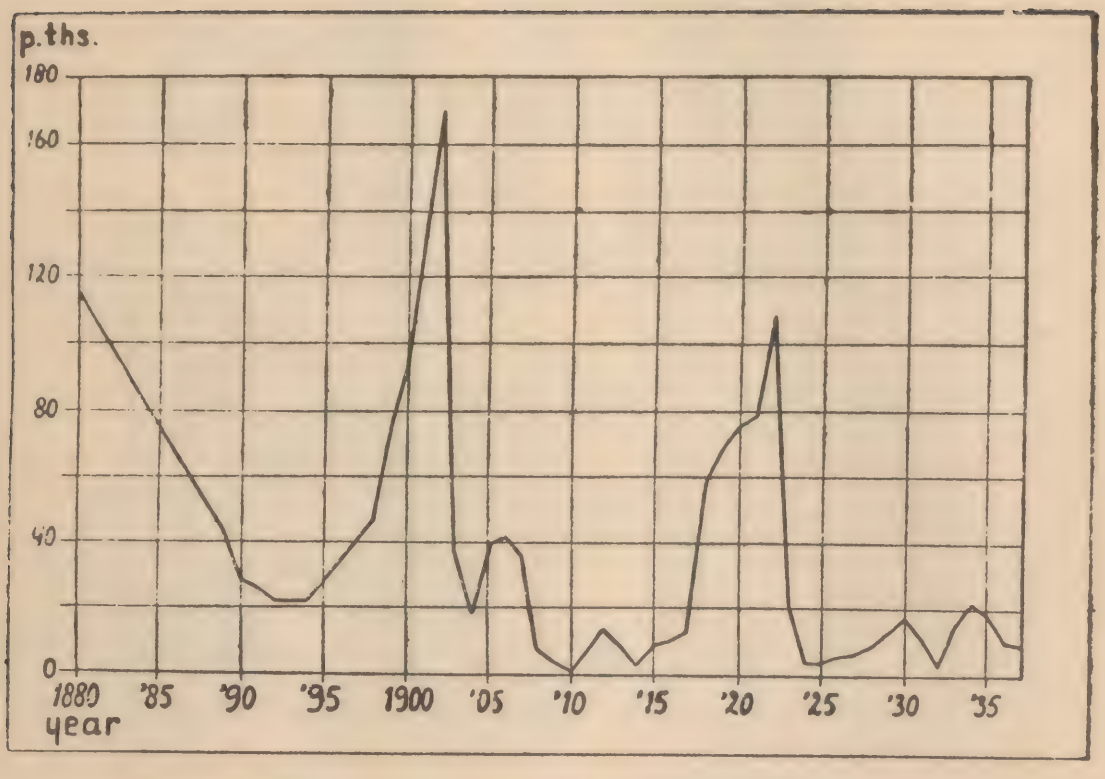

Fig. 11. Annual variation of malaria incidence in one of the malarious areas of North Holland between 1880 and 1937.
From Swellengrebel N.H. & DeBuck A.
Malaria in the Netherlands, 1938, p. 36

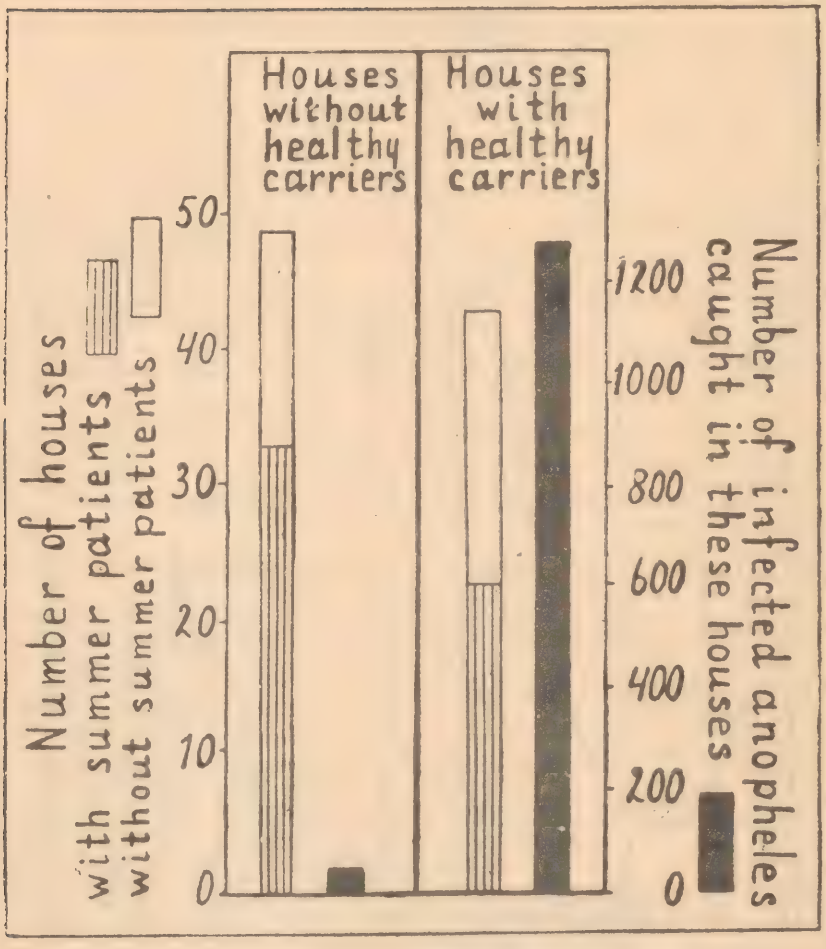

Fig.12 Showing that in houses with summer malaria patients and healthy carriers more infected anophelines are found than in houses with summer malaria patients only.
Left section: houses with summer malaria patients but without healthy carriers.
Right section: houses with summer malaria patients and healthy carriers.
Shaded columns: houses with summer patients.
White columns: houses without summer patients
Black columns: number of infected mosquitoes caught in these houses.

From Swellengrebel N.H. & DeBuck A. Malaria In The Netherlands, 1938, p.171


PROVISIONAL EDITION
FREE
THE NETHERLANDS
NORTH SEA
IJSSEL MEER
AMSTERDAM
ROTTERDAM
B E L G I U M
G E R M A N Y
HOOK OF HOLLAND
'S-GRAVENHAGE
LEIDEN
DELFT
GOUDA
UTRECHT
AMERSFOORT
ARNHEM
NIJMEGEN
APELDOORN
ZUTPHEN
DEVENTER
ZWOLLE
KAMPEN
ENKHUIZEN
HOORN
ALKMAAR
HAARLEM
ZANDVOORT
IJMUIDEN
VELSEN
UITGEEST
HILVERSUM
BAARN
BEDEMBLIK
DEN HELDER
STAVOREN
HARLINGEN
LEEUWARDEN
GRONINGEN
ASSEN
MEPPEL
STEENWYK
EMMEN
NIEUWESCHANS
WIERDEN
ALMELO
OLDENZAAL
ENSCHEDE
HENGELO
AMAUS
WINTERSWYK
ZEVENAAR
KESTEREN
GELDERMALS
DIEREN
EDE
WOERDEN
DORDRECHT
MOERDYK
GEERTRUIDENBERG
'S-HERTOGENBOSCH
GENNEP
BREDA
TILBURG
BOXTEL
EINDHOVEN
ROOSENDAAL
VLISSINGEN
TERNEUZEN
SAS VAN GENT
OMMELST
BLERICK
VENLO
ROERMOND
SUSTEREN
SITTARD
HEERLEN
MAASTRICHT
0 10 20 30
MILES
0 10 20 30 40 50
KILOMETERS
BASE MAP
MAP NO 1043 AUG. 26, 1942

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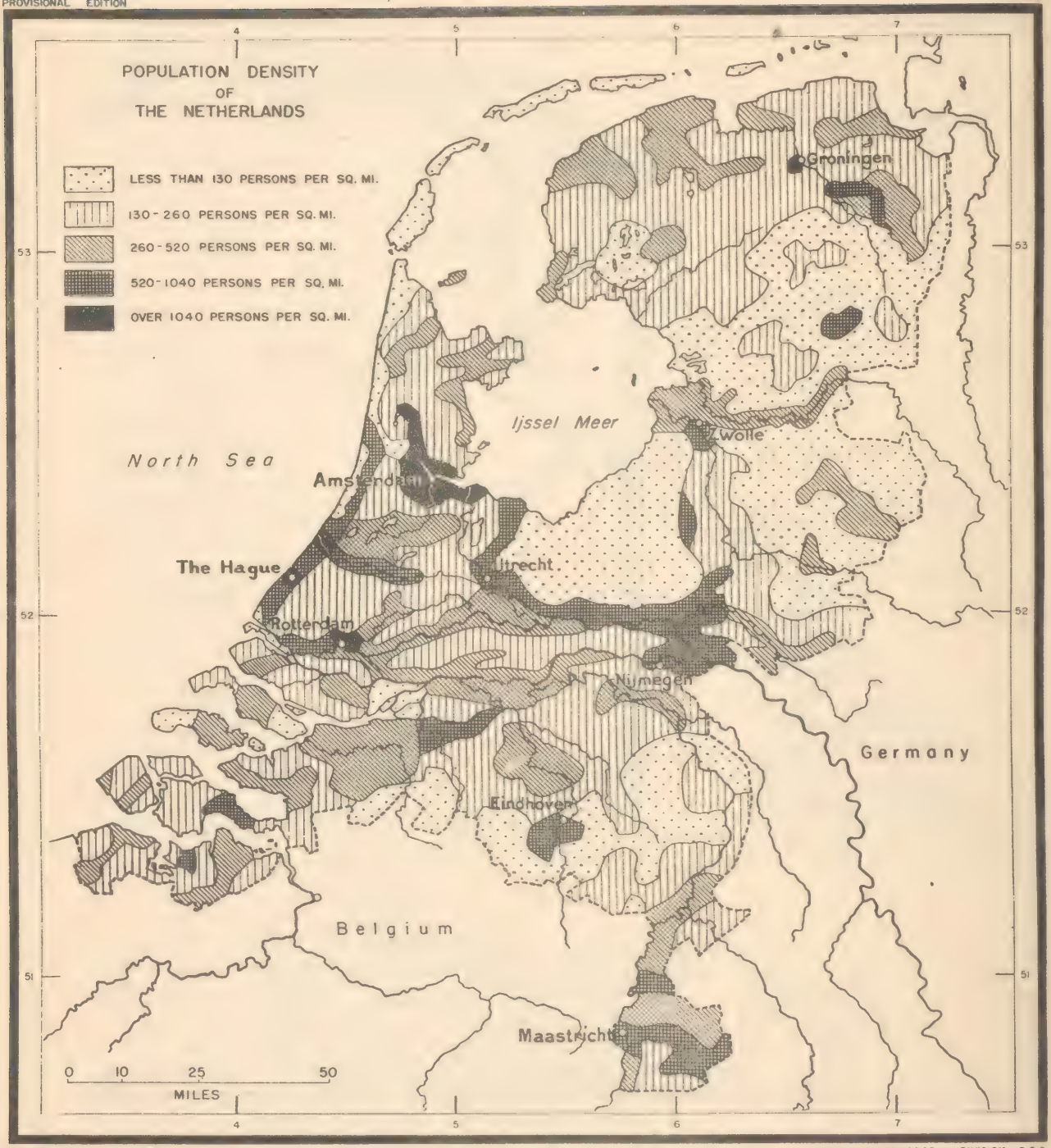

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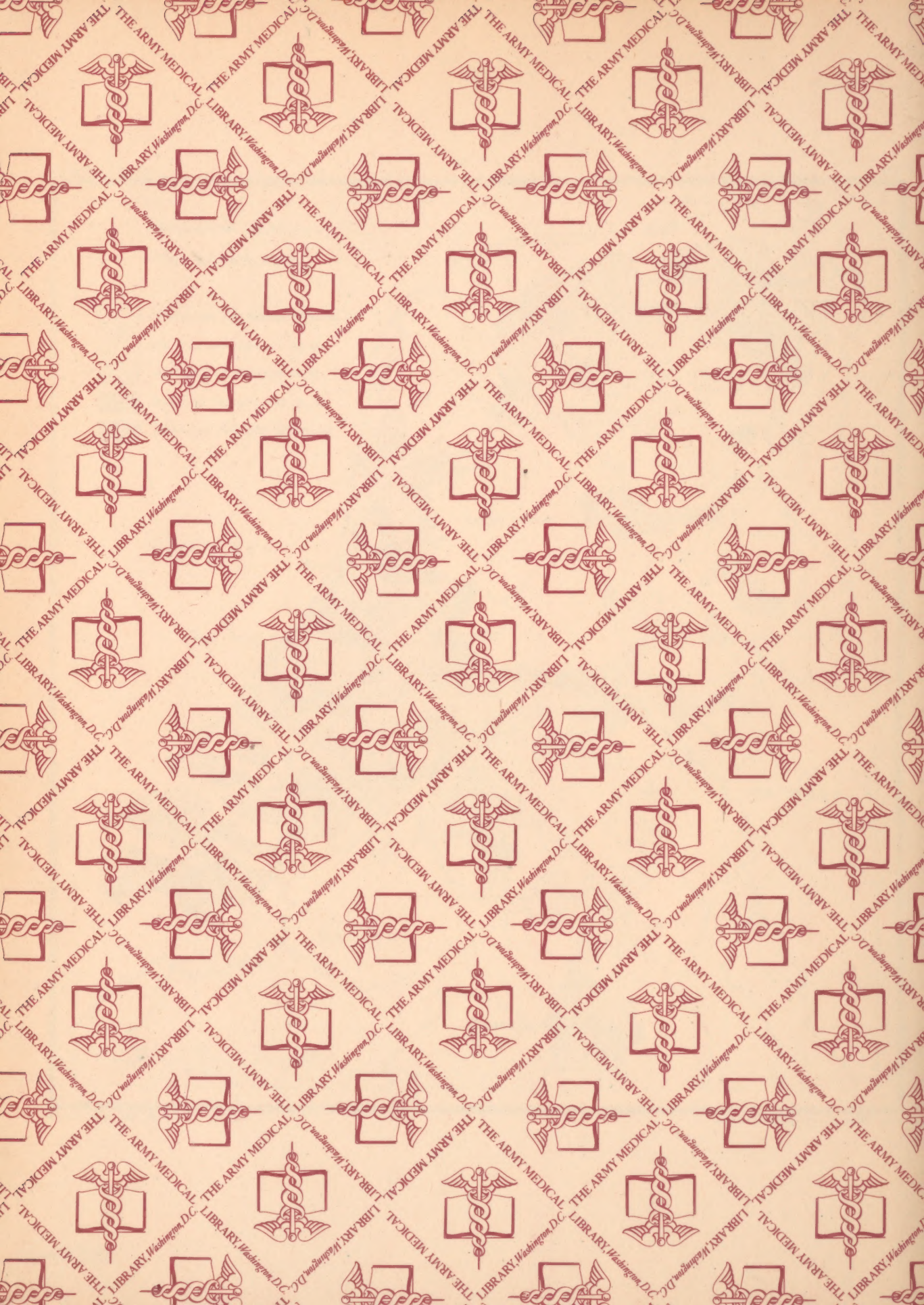
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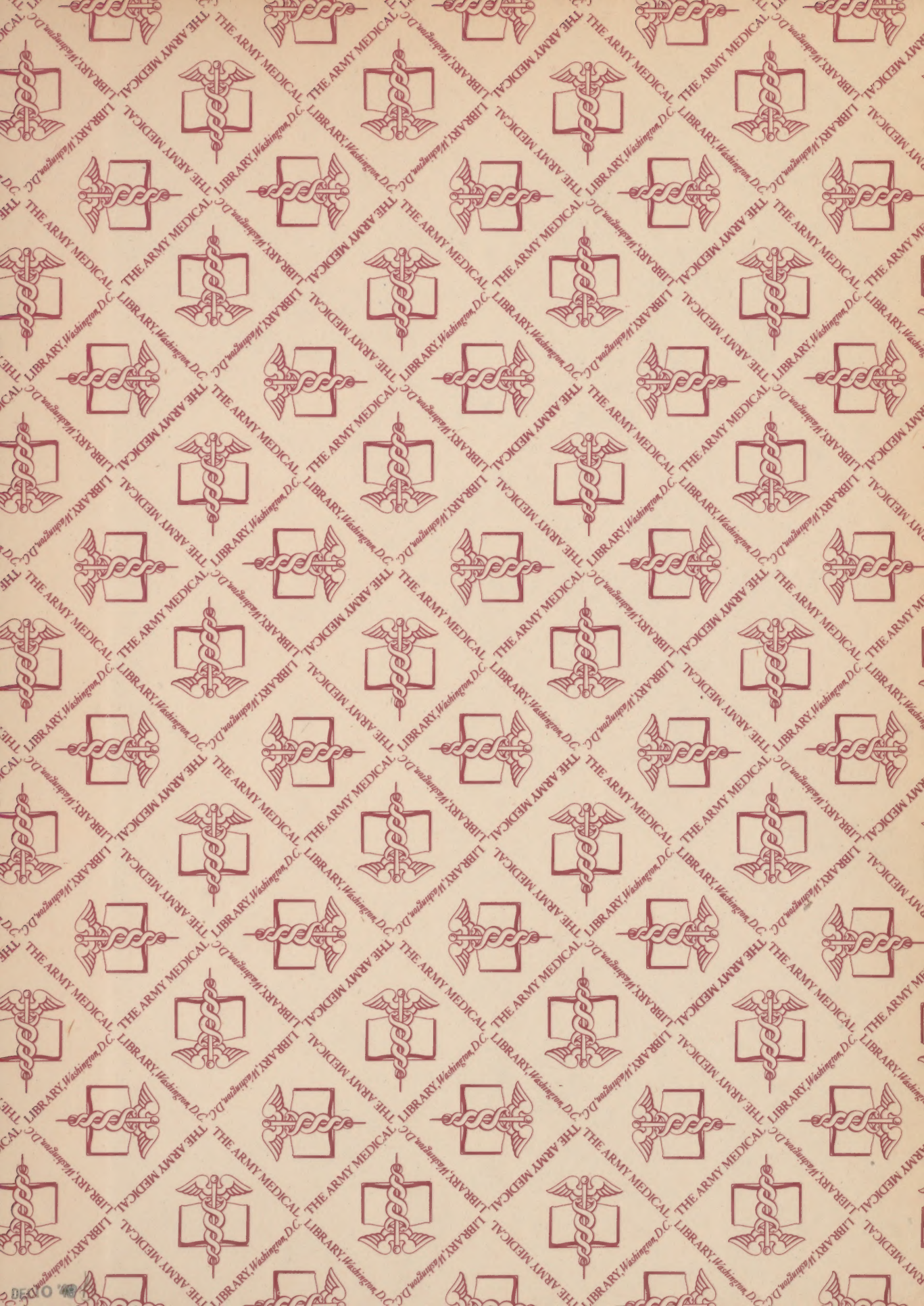
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